BMX ERT 1604 T

M340 ERT Module
User Manual

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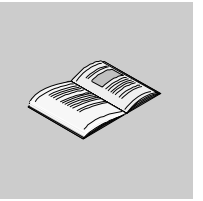

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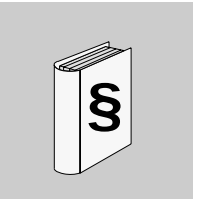
Safety Information



Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a Danger safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION
CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE
NOTICE is used to address practices not related to physical injury.

PLEASE NOTE

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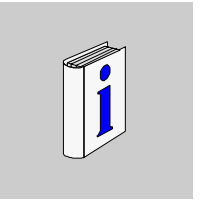
A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

About the Book



At a Glance

Document Scope

This document describes the functionality and performance scope of the BMX ERT 1604 T module.

Validity Note

This documentation is valid for Unity Pro V7.0 or later.

Related Documents

Title of Documentation	Reference Number
Quantum Ethernet I/O System Planning Guide	S1A48959
Quantum Ethernet I/O Ethernet Remote I/O Modules Installation and Configuration Guide	EIO0000001121 00 (ENG); EIO0000001122 00 (FRE); EIO0000001123 00 (GER); EIO0000001124 00 (SPA); EIO0000001125 00 (ITA); EIO0000001126 00 (CHS)
Modicon M340 Using Unity Pro	35012676
PSx: RIO Network (CRP/CRA Modules)	S1A48978
Remote I/O Cable	35014629

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User Comments

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Functional Overview

I

Overview

This part provides an overview of structure, architecture, functionality, and typical applications of the BMX ERT 1604 T module.

What Is in This Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
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2	User Functions	13
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Introduction

1

Module Overview

Brief Description of the Module

The BMX ERT 1604 T module features all the characteristics of a regular 16-channel discrete input module. The added value of BMX ERT 1604 T module is the time stamping function which records the change (rising or falling) of each input channel. To ensure the precision of time stamps, the module is able to get time code from GPS or DCF77 receiver.

The 16-channels discrete input can also be used as counter inputs; the counters feature increasing counting with the clear function.

The BMX ERT 1604 T module inputs are compatible with the following rated voltages: 24 Vdc, 48 Vdc, 60 Vdc, 110 Vdc and 125 Vdc. The inputs use positive (sink) logic.

BMX ERT 1604 T Architectures

The BMX ERT 1604 T module supports 2 kinds of architectures:

- Local Architecture - The BMX ERT module works with a BMX CPU module in the local drop.
- Remote Architecture - The BMX ERT module works with a BMX CRA (remote I/O adaptor) module which is connected to a remote CPU (for example, Quantum CPU) via Ethernet.

Refer to the Typical Applications *(see page 49)* for detailed description.

User Functions

2

Overview

The 16 inputs of the BMX ERT 1604 T module can be individually preprocessed and transferred to the PLC as binary values, counter values, or events.

What Is in This Chapter?

This chapter contains the following sections:

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2.1 Introduction

Main Functions

Overview

The BMX ERT 1604 T module has the following 3 main user functionalities:
Discrete input: Standard discrete input without time stamp.
Time Stamping: The discrete input with the time stamps recorded to mark input state changes.
Counter: This function counts pulses from the discrete input channels.

The inputs are in 4 groups and contains with 4 input channels in each group. Input functions can be configured by input group:

Input Group	Input Channels	Selectable Functions
0	0, 1, 2, and 3	Time stamping
1	4, 5, 6, and 7	Discrete input Time Stamping (default) Counter
2	8, 9, 10, and 11	Discrete input Time Stamping (default) Counter
3	12, 13, 14, and 15	Discrete input Time Stamping (default) Counter

NOTE: The discrete input function is connotative for both Time stamping and Counter functions. You can inhibit the time stamping by configuring Channel *x* used = Disable for each channel.

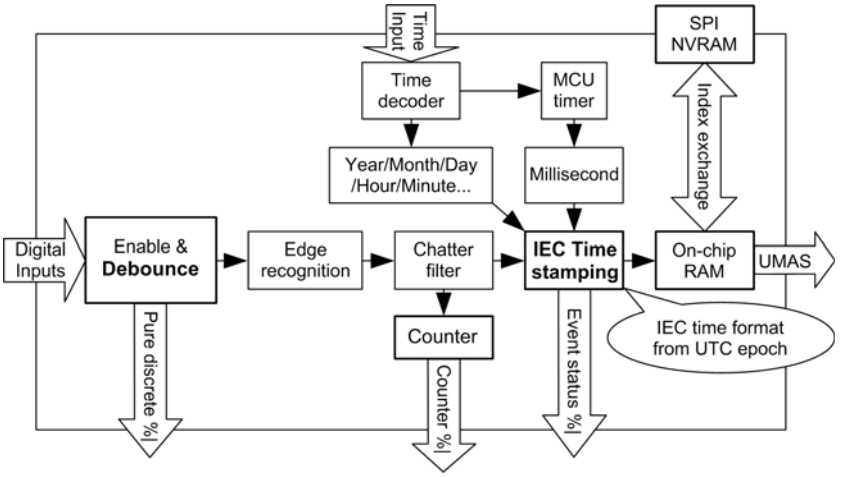
Sub-functions of Main Function

The following table shows the sub-functions of each main function:

Main Function	Sub-function
Discrete input	Multi-voltage input ranks Debounce filter Enable Supply monitor
Time Stamping	Multi-voltage input ranks Debounce filter Dechatter filter Enable Edge detection Event storage Time synchronization Supply monitor
Counter	Multi-voltage input ranks Debounce filter Dechatter filter Enable Edge detection Counting function Supply monitor

Logical View

The following figure shows the logical view of the BMX ERT 1604 T module:



2.2 Discrete Input

Overview

This section describes discrete input function of the BMX ERT 1604 T module.

In discrete input, the basic value of each channel is transferred to the platform by the implicit variable.

Parameter Type	Parameter Name	Valid Values	Details
Input implicit	Channel *x* value (x = 0...15)	0 = Logical level 0 1 = Logical level 1	Available in: • Device DDT • IODDT • Debug screen

What Is in This Section?

This section contains the following topics:

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Multi-voltage and Supply Monitor Sub-functions	18
Debounce Filter	19

Disable

Overview

The feasibility is given to disable each discrete input channel.

Parameter	Symbol	Valid Values	Description	
`Configuration`	Channel *x* used (x = 0...15)	0: Enable (default) 1: Disable	Effective range: Organization:	Channel Each group

NOTE: The discrete input value of disabled channel keeps 0.

Multi-voltage and Supply Monitor Sub-functions

Overview

To adapt to different voltage ranges, the module supports 3 ranks for 5 rated voltages. This option is available for time stamping, discrete input, and counter functions.

The rated voltage configuration acquires the supply monitor function, which alarms the power interruption case for each rank.

The configuration allows disabling the supply monitor, otherwise the error message will be denoted by the variable (if enabled).

Parameter Description

Parameter Type	Parameter Symbol	Valid Values	Details	
`Configuration`	Rated voltage	0: 24 Vdc (default) 1: 48/60 Vdc 2: 110/125 Vdc	Effective range	Module
			Organization	Group 0
`Configuration`	Supply monitoring	0: Disable 1: Enable (default)	Effective range	Module
			Organization	Group 0

NOTE: If the **Supply monitoring** is enabled, the input state of each discrete channel is forced to 0 when a field supply failure is detected and the module stops the event detection until the field power supply recovers.

If the last input value is 1, then an event is generated when the input state is forced to 0 but the **TimeAccuracy** for this event shows an **IO Channel error**.

Status Description

Status Type	Status Symbol	Values	Details
`Status Explicit`	`EXT_PWS_FLT`	0: No fault 1: Power supply interruption for supply monitoring	Available in: • Device DDT • IODDT • Fault screen

Debounce Filter

Overview

The purpose of debounce function is to adapt the discrete input for mechanical switches. The programmable debounce filter can also be used to reduce the transient interference.

Debouncing inhibits the processing of fast state changes.

The value range for the filter time is 0...255 ms; the value 0 deactivates the debounce filter. The default value in Unity Pro is 1.

A debounce filter may be either:
- Steady State
- Integrating

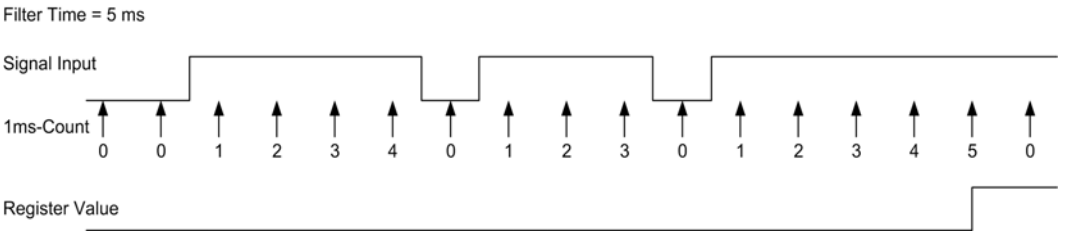
The following table shows the parameters of the debounce filter function:

Parameter	Symbol	Valid Values	Unit	Description	
`Configuration`	Debounce filter type	0: Steady state 1: Integrating	–	Effective range	Group
				Organization	Each group
`Configuration`	Channel *x* debounce time (x = 0...15)	0...255 (default: 1)	ms	Effective range	Group
				Organization	Each group

NOTE: Excessive debounce time may cause the loss of effective events.

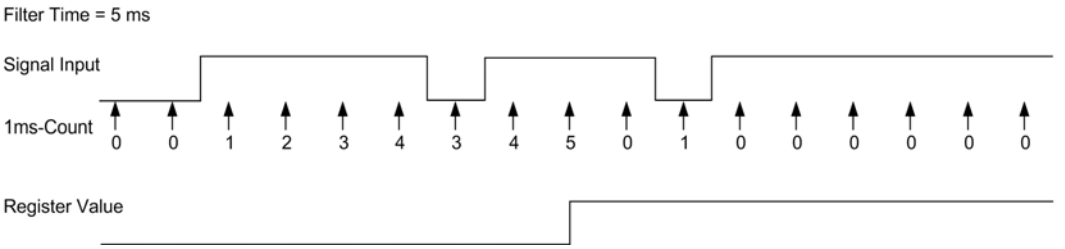
Steady State Filtering

A signal change is registered only if the polarity change remains stable for longer than the filter time (each new change resets the filter time).



Integrating Filtering

A signal change is registered only if the time integral of the input signal reaches the programmed filter time considering any polarity change.



NOTE: Debounce time ≥ 1 ms is recommended to provide enough immunity from electromagnetic disturbances.

The following table shows the parameters of the debounce filter function:

Parameter Type	Parameter Name	Valid Values	Unit	Details	
Configuration	Debounce filter type	0: Steady state 1: Integrating	–	Effective range:	Group
				Organization:	Each group
Configuration	Channel *x* debounce time (x = 0...15)	0...255 (Default: 1)	ms	Effective range:	Channel
				Organization:	Each group

NOTE: The setting of debounce time affects the time stamping accuracy because the recognition of transition is delayed.

⚠ CAUTION

UNEXPECTED BEHAVIOR OF APPLICATION - INCORRECT INTERPRETATION OF INPUT DATA

Debounce filters are used to suppress the input recognition in a defined way. Filtering should only be used in a suitable way to prevent too much or undesired suppression of input data.

Failure to follow these instructions can result in injury or equipment damage.

2.3 Time Stamping Sub-functions

Overview

The time stamping function includes the full functions of discrete input *(see page 16)* containing the normal discrete input function along with the implicit variable presenting the input state for each channel.

The time stamping function also uses the following sub-functions:

- Dechatter filter
- Time synchronization
- Event storage

What Is in This Section?

This section contains the following topics:

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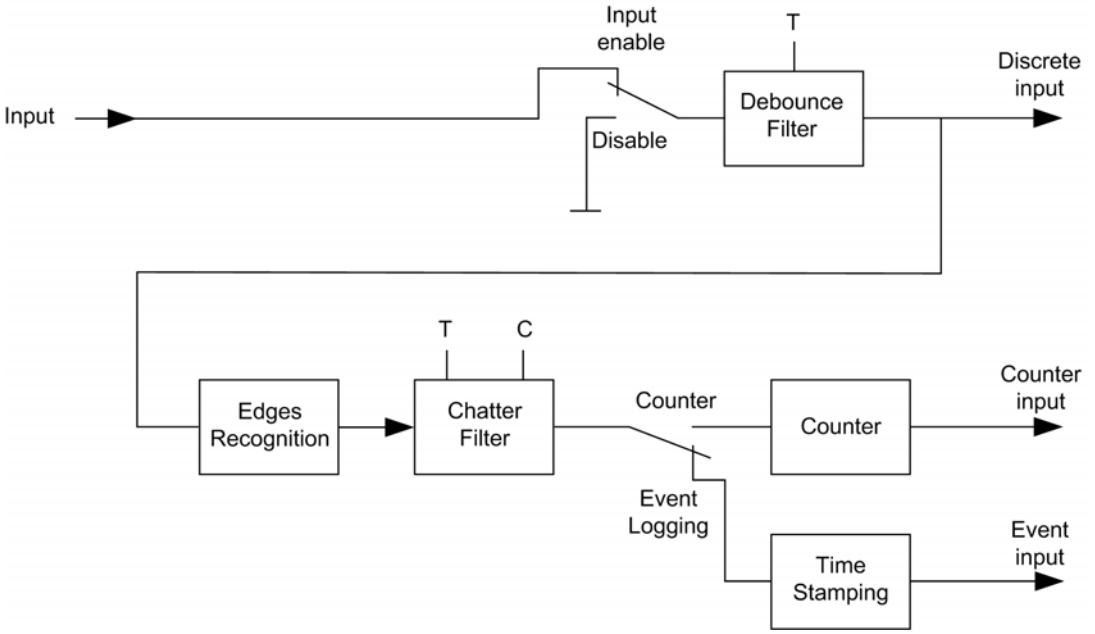
Edge Detection

Overview

The BMX ERT 1604 T module can detect the edge of state change on each discrete input channel. For time stamping function, the module always detects both rising and falling edges.

Parameter Type	Parameter Symbol	Valid Values	Description	
`Configuration`	Channel *x* edge (x = 0...15)	0: Both (default) 1: Rising (Only for counter) 2: Falling (Only for counter)	Effective range	Channel
			Organization	Each group

The following figure shows the input processing:



Dechatter Filter

Overview

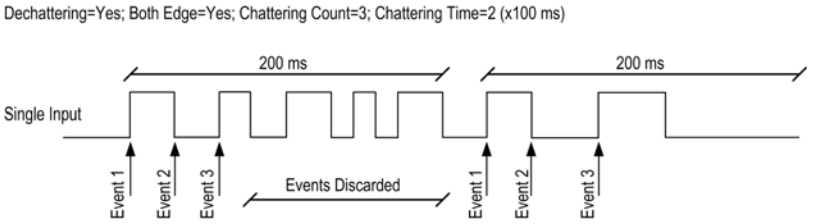
The dechatter function limits the number of events within a configurable value during a configurable time period. This filter reduces the number of event registrations for the same input so that events such as, low slew rate inputs should not disturb the recording of desired events.

The dechatter filter requires the following 2 configurable parameters:

Chatter Counter (C): This value defines the first count (C) number of edges recorded. Edges received after this count (C) reached within a specified duration (T) are discarded. The value range is from 1...255.

Chatter Time (T): This value defines the duration for chatter time. The first rising or falling edge (or, the first edge after the end of last (T) confirms the beginning of current chatter time. Within the configured (T) only (C) number of edges is recorded. The value range is 1...255 where each number represents an unit of 100 ms (that is, 0.1...25.5 s).

The following figure shows the dechatter filter:



The following table describes the parameters and is provided with enable bit to activate or deactivate the dechatter filter:

Parameter Type	Parameter Symbol	Valid Values	Unit	Description	
`Configuration`	Chatter count	1...255 (default: 1)	–	Effective range	Channel
				Organization	Each group
`Configuration`	Chatter time	1...255 (default: 1)	100 ms	Effective range	Channel
				Organization	Each group

Parameter Type	Parameter Symbol	Valid Values	Unit	Description	
Configuration	Dechatter filter	0: Disable 1: Enable (default: 1)	–	Effective range	Group
				Organization	Each group
Implicit	Dechatter active	0: Inactive 1: Active	–	Available in: • Device DDT • IODDT • Debug screen	

The dechatter active bit describes the status of dechatter filter.

When an edge is discarded by dechatter filter, the dechatter active bit is set to 1 and is cleared at the end of current (T) duration.

NOTE: With the enabled dechatter filter and certain condition of input pattern, a recorded rising edge can be followed by another rising edge recorded (as shown in the previous figure), or a recorded falling edge can be followed by another falling edge recorded.

⚠ CAUTION

UNEXPECTED APPLICATION BEHAVIOR – INCORRECT INTERPRETATION OF INPUT DATA

Dechatter filters are used to suppress the input recognition in a defined way. Filtering should only be used in a suitable way to prevent too much or undesired suppression of input data.

Failure to follow these instructions can result in injury or equipment damage.

Time Synchronization

Overview

The BMX ERT 1604 T module receives the broadcast time code input from the IRIG port or DCF port (only 1 format is allowed at a time).

The external time codes not only provide the year, month, day, hour, minute, and second (IRIG-B) information, but also provide the on time edge at each second (IRIG-B) or minute (DCF77). This enables to synchronize the internal clock of the module with the external clock.

The following parameters are provided to support the time synchronization function:

Parameter Type	Parameter Name	Valid Values	Details	
Configuration	Clock SYNC source	0: Free running/internal clock 1: DCF77/external clock 2: IRIG-B/external clock (default)	Effective range:	Module
			Organization:	Group 0
Implicit	TIME_VALID	0: Invalid 1: Valid	Available in: Device DDT IODDT Debug screen	
Implicit	CLOCK_FAILURE	0: No fail 1: Fail	Available in: Device DDT IODDT Debug screen	
Implicit	CLOCK_NOT_SYNC	0: Synchronized 1: Not synchronized	Available in: Device DDT IODDT Debug screen	

Clock SYNC Source

In addition to the 2 external clock sources, you can also choose **Internal clock**.

Free running/Internal clock: The module uses the internal clock. After the module is initialized, the start time is changed to 1970-01-01 00:00:00:000 as defined in IEC61850.

DCF77/External clock: Timing is synchronized to a timing code received on the DCF input port.

IRIG-B/External clock: Timing is synchronized to a timing code received on the IRIG input port.

NOTE: When the external clock options are selected, the BMX ERT 1604 T module stays in the free running mode (begins from 1970-01-01 00:00:00:000 after initialization) till the first successful synchronization with the external clock.

Clock Failure

An error message bit activates if the module detects that the time frame is invalid. When the external clock source is selected, an error message bit is asserted and the external time clock is detected as invalid.

The following conditions are considered invalid time frames, when:

- The wrong mark/space ratio for 0 or 1 signaling
- The wrong mark/space ratio for reference bit signaling
- The wrong check bit provided by DCF or IRIG
- The time frames are not continuous

This bit is cleared when a valid time frame is received and is continuous to current internal time. The initial value will be 1 after start.

NOTE: When the free running/internal clock option is selected, `CLOCK_FAILURE` always keeps 0.

Clock Not SYNC

When the external clock source is selected, the synchronizing effort reaches 10 s (IRIG-B) or 10 ms (DCF-77) without success, this bit is asserted to declare the `CLOCK_NOT_SYNC`. And it will be cleared once the time is synchronized. After initialization, this bit keeps 1 till the first successful synchronization.

NOTE: When the free running/internal clock option is selected, `CLOCK_NOT_SYNC` always keeps 1.

Time Valid

The value of this bit is decided by Clock SYNC source option, and the state of CLOCK_FAILURE and CLOCK_NOT_SYNC bits.

The **(T)** LED on the display panel which denotes the synchronization status acts base on the combination of these parameters:

Clock SYNC Source	CLOCK_FAILURE	CLOCK_NOT_SYNC	TIME_VALID	LED (T) (green)
IRIG-B or DCF77	0	0	1	ON
IRIG-B or DCF77	1	0	0	FLK
IRIG-B or DCF77	1	1	0	OFF
Internal Clock	0	1	0	

NOTE: Any status of the time quality bits (TIME_VALID, CLOCK_FAILURE, CLOCK_NOT_SYNC) will not stop the event recording for BMX ERT 1604 T module.

NOTE: With an IRIG-B external clock, if IEEE1344 or IEEE C37.118 standards are not supported, then CLOCK_FAILURE and CLOCK_NOT_SYNC bits can be set to 1 during the switch between daylight saving time and standard time.

In any case, 13 seconds (IRIG-B external clock) or 13 minutes (DCF77 external clock) after switch between daylight saving time and standard time, stamping time is synchronized with the external clock regardless the error bits status. Once synchronized, CLOCK_FAILURE and CLOCK_NOT_SYNC bits are reset.

Event Storage

Event Data Format

A dedicated FIFO block provides space for storage and transfer of the event information.

The event data includes the information of edge polarity (rising or falling), event ID, and time quality.

The following table describes the FIFO space distributed for a time stamp data unit:

Reserved			Byte 0
Value			Byte 1
Event ID		Bit 7...0	Byte 2
		Bit 15...8	Byte 3
DateAndTime	SecondSinceEpoch	Bit 7...0	Byte 4
		Bit 15...8	Byte 5
		Bit 23...16	Byte 6
		Bit 31...24	Byte 7
	FractionOfSecond	Bit 7...0	Byte 8
		Bit 15...8	Byte 9
		Bit 23...16	Byte 10
TimeQuality			Byte 11

The following table describes the meaning of each data block:

Attribute Name	Attribute Type	Description/Value
Reserved (Byte 0)	BYTE	Reservation for future use. This byte is set to 0.
Value	BYTE	Value of the variable after change detection: Bit 0: Falling edge (0), Rising edge (1)
Event ID	WORD	Identification of the variable is automatically assigned by the configuration tool. **NOTE:** The identification must be unique for system time stamping.
DateAndTime	TIMESTAMP	Date and time of the variable change detection

The following table describes the format for DataAndTime data block:

Timestamp Type Definition		
Attribute Name	**Type**	**Description/Value**
SecondSinceEpoch	INT32U	(0...MAX)
FractionOfSecond	INT24U	See the following table for more information on FractionOfSecond
TimeQuality	TIMEQUALITY	–

The time format is defined according to *IEC 61850-7-2 Edition 2*.

The definitions of the attributes are as follows:

SecondSinceEpoch: Number of seconds since midnight (00:00:00) 1970/01/01 (UTC time).

FractionOfSecond:

FractionOfSecond	
SEC_1970_0...3	UINT32 little endian encoding
FRACT_SEC_0 (LSByte)	B7-B0
FRACT_SEC_1	B15-B8
FRACT_SEC_2 (MSByte)	B23-B16 (B23 = 1 for 1/2 s)
TimeQuality	B7-B0 (B7 = LeapsSecondsKnown)

FRACT_SEC_2 (MSByte)								**FRACT_SEC_1 (2nd byte)**								**FRACT_SEC_0 (LSByte)**							
23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

The following table describes the format for TimeQuality data block:

TimeQuality Definition		
Attribute Name	**Type**	**Description/Value**
–	PACKED LIST (8 bits)	–
LeapsSecondsKnown	BOOLEAN (B7)	–
ClockFailure	BOOLEAN (B6)	–
ClockNotSynchronized	BOOLEAN (B5)	–
TimeAccuracy	CODED ENUM (B4...B0)	Number of significant bits in the FractionOfSecond Minimum time interval is 2**-n

For example, Encoding of LeapSecond = 0, ClockFailure = 0, ClockNotSynchronized = 0, TimeAccuracy = 3 bits: TimeQuality = 0x03.

LeapSecondsKnown: This bit is set to FALSE.
ClockFailure: Indicates same meaning with the I% (implicit variable) CLOCK_FAILURE.
ClockNotSynchronized: Indicates same meaning with the I% (implicit variable) CLOCK_NOT_SYNC.
TimeAccuracy: In IEC norm, the TimeAccuracy represents the number of significant bits N in the FractionOfSecond.

- For the 1 ms time stamp resolution of BMXERT module, TimeAccuracy is set to 0xx01010.
- If ClockNotSynchronized = 1, or if ClockFailure = 1 the TimeAccuracy still keeps its usual value (as if the Clock is synchronized).

Time accuracy is also used to set specific values of TimeQuality as described in the following table:

TimeAccuracy Specific Values	**Values**	**Comments**
Invalid	0xx11110	Used in case of buffer full
IO Channel error	0xx11101	Used in case of IO Channel error detection
TSInit	0xx11100	Used in case of synchronization of the values with the client (done by storing a virtual event with 16-ch discrete values inside the buffer)
ClockInSync	0xx11011	Used in case of external clock during synchronization

If several errors are detected, the precedence of TimeAccuracy specific values are:
1. TimeAccuracy = IOChannelError (highest prioritority)
2. TimeAccuracy = Invalid or TSInit
3. TimeAccuracy = ClockInSync
4. TimeAccuracy = Unspecified

Event ID

Under system solution configuration, the event ID is assigned for each channel by the system to identify which channel the event belongs to. So that, this ID will be packed together with the event data package.

Parameter Type	Symbol	Valid Values	Description	
Configuration	Channel *x* event ID (x = 0...15)	Read-only	Effective range	Channel
			Organization	Each group

Under application solution, the event ID will be replaced by the topological address of the channel:

- 0...15 for channel *x* event ID
- 16 for SOE uncertain event ID

NOTE: Except the event ID for discrete channels, in case of buffer full, this event ID in the event buffer is loaded by SOE uncertain event ID to denote a buffer full or free event. For more details refer to the *Behavior Mode (see page 34)* section.

Event FIFO Management

The planned space for event storage is limited. You must consider an overflow buffer to handle conditions where the incoming rate of event bursts are greater than the event acquisition rate.

The following configuration and status parameters can be used to manage the overflow issues:

Parameter Type	Symbol	Valid Values	Unit	Description	
Configu-ration	Buffer threshold	Fixed by 70%	%	Effective range:	Module
				Organization:	Group 0
Configu-ration	SOE uncertain event ID	Read-only and assigned by system	–	Effective range	Module
				Organization	Group 0
Status Implicit	TIME_STAMP_RECORDS	0...Full value	–	Available in: Device DDT IODDT Debug screen	
Status Implicit	BUFF_FULL	0: No full 1: Full	–	Available in: Device DDT IODDT Debug screen	

Parameter Type	Symbol	Valid Values	Unit	Description
`Status Implicit`	TS_BUF_FILLED_PCTAGE	0...100%	–	Available in: Device DDT IODDT Debug screen
`Status Implicit`	UMAS communication error	0: No error 1: Error	–	Available in: DDT Device IODDT Debug screen
`Command Implicit`	Clear event buffer	A rising edge from 0 to 1 clears the whole buffer **NOTE:** Only available for applicative time stamping mode.	–	Available in: Device DDT IODDT Debug screen

TIME_STAMPS_RECORDS: This word contains the number of time stamp records (event number) available in the local buffer.

BUFF_FULL: BUFF_FULL bit is set to 1 on buffer full detection. BUFF_FULL bit is cleared after a buffer full threshold is reached, that is, when percentage of events in the buffer is ≤buffer threshold (70%). Refer to the *Behavior Mode (see page 34)* for the module behavior for buffer full case.

The event record and detection always stops after the buffer is full. This means that the latest events are lost during the buffer full period.

Buffer threshold: After the buffer is full, the BMXERT module automatically recovers the event record when the buffer occupancy is lower than the buffer threshold.

PERCENTAGE_OF_BUFFER_FILLED: Both buffer threshold and TS_BUF_FILLED_PCTAGE use the percentage for indication. The percentages are calculated by group number instead of event number. The event number varies from 1...16 in one group. The number depends on how many channels get the events occurred within the same 0.5 ms sampling window.

SOE uncertain event ID: The buffer full event is treated as a special event from a virtual channel, therefore the unique event ID is assigned by the system. After the buffer full event occurs, the buffer full event with this ID is inserted into the event data sequence immediately. For more details refer to the *Behavior Mode (see page 34)* section.

The SOE uncertain ID is 16 under applicative solution mode. For more details refer to the *Event ID (see page 31)* topic.

Clear event buffer: A rising edge from 0 to 1 of this command implicit clears the whole event buffer. This parameter is only available for the applicative time stamping mode *(see page 107)*.

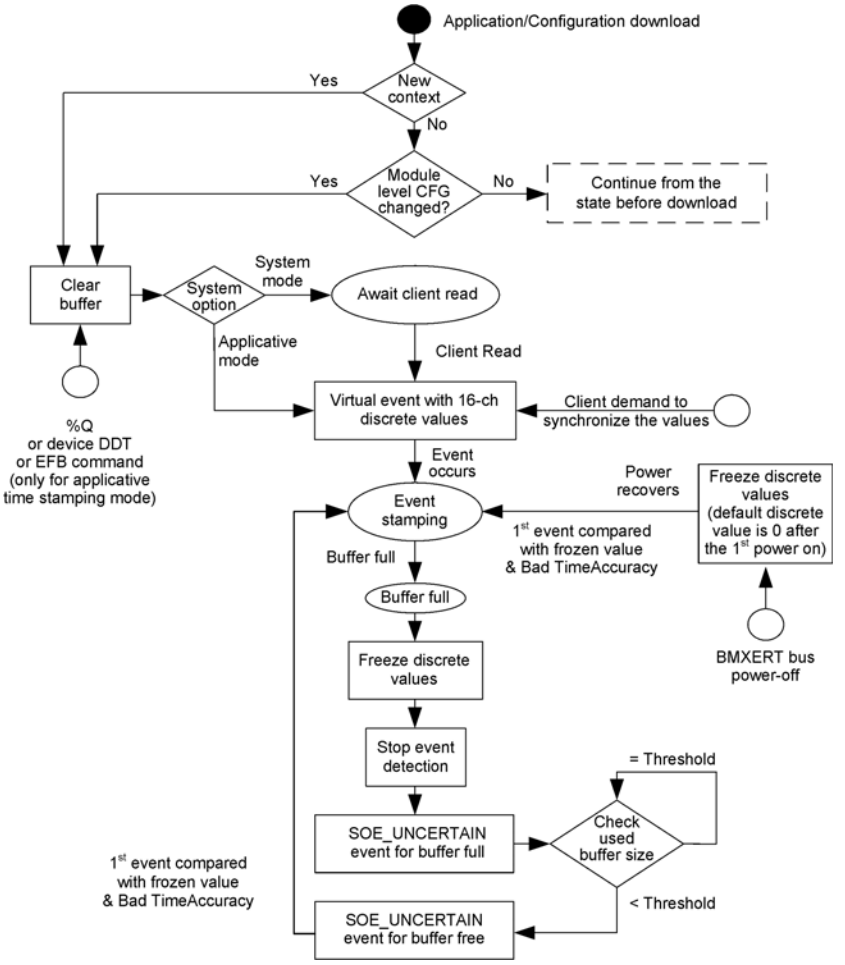
NOTE: The **Clear event buffer** command must be used to clear the event buffer before the BMX ERT 1604 T module is reassigned to new application. Otherwise, the remaining event data of last application can be kept in the buffer.

Behavior Mode

Overview

This section describes the module behavior modes for different phases or use cases. It involves the buffer management, the special features for system solution, and so on.

Time Stamping



Application/Configuration Download

It includes all the operations which cause a physical download such as customer operation, auto download after power-on, and hot swap.

System/Application Solution

Parameter Type	Parameter Name	Valid Values	Details	
`Configuration`	Solution mode option	System or Applicative	Effective range:	Module
			Organization:	Group 0

NOTE: The system mode only takes time stamping channels into account.

New Context

The new context is defined as the occurrence of new configuration creation ID. The configuration creation is stored in the configuration parameter of BMX-ERT.

Parameter Type	Parameter Name	Valid Values	Details	
`Configuration`	Configuration creation ID	Read-only	Effective range:	Module
			Organization:	Group 0

Module Level CFG

The module level configuration parameters include:

- Related voltage
- Clock SYNC source

Client Read

Reception of a TS Events client request shows that the client is connected.

Client demand to synchronize the values

Reception of a synchronization request from the TS Events client (sent in case of restart of the SCADA).

Virtual Event

The virtual event in the buffer queue is not generated for a real external event, it is provided to synchronize the values with the client. The values of discrete channels will be put in the event value byte of virtual event instead of the event polarity (rising or falling). The `TimeAccuracy` bits denote virtual event by 11100 as the `TSInit` symbol to be distinguished from normal events.

SOE_UNCERTAIN

The 0...1 transition of the implicit variable SOE_UNCERTAIN indicates that Sequence Of Events (**SOE**) begins to be uncertain, while the 1...0 transition signals when it is sure to be OK again. The BMXERT module generates the virtual events (include buffer full and free events) according to the transition of this bit like it does at the transition of discrete input channel for a real event.

Parameter Type	Parameter Name	Valid Values	Details
Implicit %I	SOE_UNCERTAIN	0: Certain 1: Uncertain	Available in: Device DDT IODDT Debug screen

The transition of SOE_UNCERTAIN will be applied for virtual event and buffer full/free event

SOE_UNCERTAIN Transition	Virtual Event (Value Synchro)	Buffer full/Free Event
0>1 (if not already 1)	When synchro request is received (includes init synchro)	When buffer-full is detected
1>0	When entering event stamping state	When entering event stamping state

Stop Event Detection

It means the detection for external events is stopped. But the virtual events corresponding to inserting time stamping channels is registered. Once it recovers, the virtual event is set in the buffer before the first external event is being put into this.

In addition to the 2 sources mentioned in the previous chart (buffer full or client demand to synchronize the values), the module also stops event detection on a field power supply fault phase (if the field power supply is monitored *(see page 18)*).

Bad TimeAccuracy

After recovering from the buffer free event or bus power off, the first event is compared with the last frozen discrete values, and the TimeAccuracy must be put as 11110 which denotes the invalid time. The buffer full/free event gets the normal TimeAccuracy bits (01010).

Initialization

The initialization means power-on, hot swap, application download, and module/group reboot after online configuration change.

BMXERT Field Power Failure Asserted

BMXERT field power failure asserted means the supply monitoring is enabled and the field power failure is detected.

EFB for BMX ERT 1604 T Module

Overview

The 2 EFBs that are required to operate the BMX ERT 1604 T module are:

- GET_TS_EVT_M
- GET_TS_EVT_Q

The BMX ERT 1604 T module can work with a Modicon M340 CPU or with a Quantum CPU (via BMX CRA 312 10 communication module). Each EFB is dedicated to a specific platform:

- GET_TS_EVT_M on Modicon M340 platform
- GET_TS_EVT_Q on Quantum platform

NOTE: The 2 EFBs are only available for an applicative time stamping solution.

Description of the function

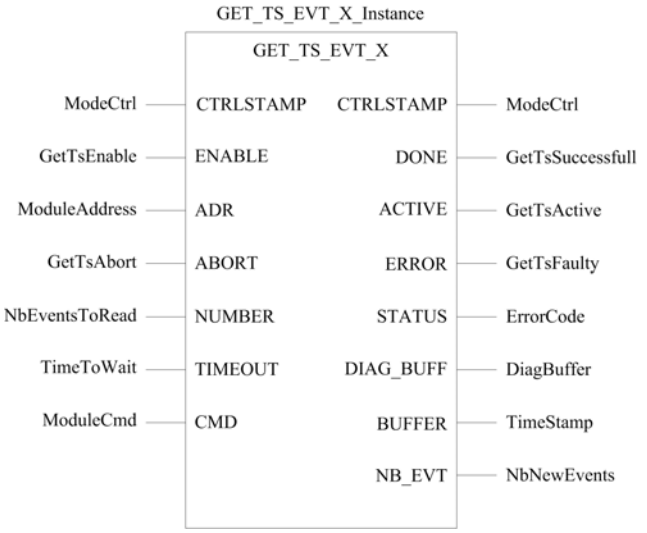
The GET_TS_EVT_M function block gets the time stamped data in a BMX ERT 1604 T module in a local drop. This function allows to read the event buffer in the source time stamped IO module (BMX ERT 1604 T) and to make it available for the Modicon M340 PLC application.

The GET_TS_EVT_Q function block gets the time stamped data in a BMX CRA 312 10 Ethernet remote IO module or in a BMX ERT 1604 T module in a remote IO drop (Quantum architecture). This function allows to read the event buffer in the source time stamped IO module (BMX CRA 312 10 or BMX ERT 1604 T) and to make it available for the Quantum PLC application.

The additional parameters EN and ENO can be configured.

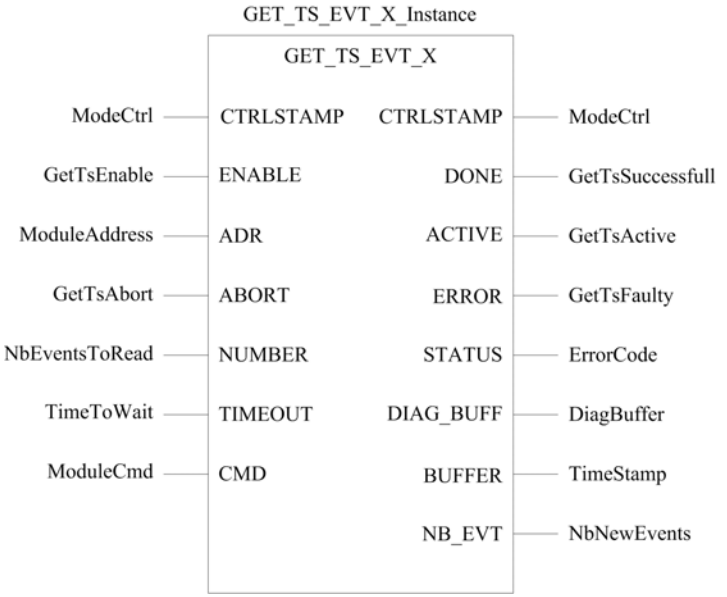
FBD representation

Representation:



LD representation

Representation:



IL representation

Representation:

```
CAL GET_TS_EVT_X_Instance (ENABLE:=GetTsEnable,
ADR:=ModuleAddress, ABORT:=GetTsAbort,
NUMBER:=NbEventsToRead, TIMEOUT:=TimeToWait, CMD:=ModuleCmd,
DONE=>GetTsSuccessfull, ACTIVE=>GetTsActive,
ERROR=>GetTsFaulty, STATUS=>ErrorCode, DIAG_BUFF=>DiagBuffer,
BUFFER=>TimeStamp, NB_EVT=>NbNewEvents)
```

ST representation

Representation:

```
GET_TS_EVT_X_Instance (ENABLE:=GetTsEnable,
ADR:=ModuleAddress, ABORT:=GetTsAbort,
NUMBER:=NbEventsToRead, TIMEOUT:=TimeToWait, CMD:=ModuleCmd,
DONE=>GetTsSuccessfull, ACTIVE=>GetTsActive,
ERROR=>GetTsFaulty, STATUS=>ErrorCode, DIAG_BUFF=>DiagBuffer,
BUFFER=>TimeStamp, NB_EVT=>NbNewEvents)
```

Description of the parameters

The following table describes the input parameters:

Parameter	Type	Comment
ENABLE	BOOL	Set to 1 to send the request to the concerned module.
ADR	ANY_ARRAY_INT	Array containing the Modbus slave address. Result of: • Result of ADDM function on a Modicon M340 CPU. • Result of ADDMX function on a Quantum CPU.
ABORT	BOOL	Set to 1 to abort the current operation.
NUMBER	INT	Maximum number of events to be read in the module local buffer.
TIMEOUT	INT	Maximum time to wait for the drop reply. The time base for this parameter is 100ms. **NOTE:** TIMEOUT = 0 corresponds to an infinite waiting value.
CMD	INT	Set to: • 0: read the module buffer • 1: reset the module buffer

The following table describes the output parameters:

Parameter	Type	Comment
DONE	BOOL	Function block completed indication. Set to 1 when the execution of the function block is completed successfully. DONE is set to 1 when the maximum number of events is reached or when the buffer is full (in Stop on buffer full mode).
ACTIVE	BOOL	Function block in progress indication. Set to 1 when the execution of the function block is in progress.
ERROR	BOOL	Set to 1 if an error is detected by the function block.
STATUS	WORD	Code providing a communication and operation report. • Byte 0: communication report • Byte 1: operation report
DIAG_BUFF	ANY_ARRAY_INT	Description: • Byte 0: Percentage of buffer filled • Byte 1: Diagnostic flags

BUFFER	ANY_ARRAY_INT	Raw buffer (size must be a multiple of 6 * INT) containing event time stamp entries:
		• Word 0:
		  • Byte 0: Reserved
		  • Byte1: Value of the variable after change detection
		• Word 1: Event ID
		• Word 2: Number of seconds since 1970/01/01 midnight (Bit 15 to 0)
		• Word 3: Number of seconds since 1970/01/01 midnight (Bit 31 to 16)
		• Word 4: Fraction of second (Bit 15 to 0)
		• Word 5:
		  • Byte 0: Fraction of second (Bit 23 to 16)
		  • Byte 1: Time quality
		NOTE: The raw buffer is a ring buffer so the maximum buffer size that can be used is reduced by 6 from the size settings.

NB_EVENT	INT	Number of new events read in the BMX ERT 1604 T local buffer (GET_TS_EVT_X) or BMX CRA 312 10 (GET_TS_EVT_Q).

The following table describes the input/output parameters:

Parameter	Type	Comment
CTRLSTAMP	DDT CTRL_STAMP	Specifies the CPU raw record buffer: ● BEGIN index: INT ● END index: INT ● Operating MODE (a detailed description of the Operating mode word is given below): WORD.

STATUS Parameter Description

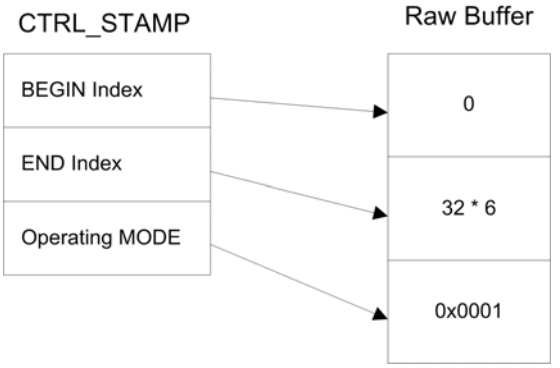
The following table describes the STATUS parameter:

Communication Report (byte 0)		Operation Report (byte 1)	
Value	**Description**	**Value**	**Description**
00 hex	Correct exchange (request processed successfully)	00 hex	Positive result
		01 hex	The number of events in the PLC buffer reaches the maximal value.
		02 hex	The buffer is full and events have been overwritten since the last exchange.
		04 hex	Buffer is full and the recording stops
01 hex	Exchange stop on timeout	00 hex	Default value
02 hex	Exchange stop on user request (CANCEL)	00 hex	Default value
03 hex	Incorrect address format	00 hex	Default value
04 hex	Incorrect destination address	00 hex	Default value
06 hex	Incorrect specific parameters	01 hex	Invalid CMD parameter.
		02 hex	User parameters have changed between 2 invocations while the EFB execution is active.
09 hex	Insufficient receive buffer size (<1 EVT)	00 hex	Default value
0B hex	No processor system resources	00 hex	Default value
FF hex	Incorrect exchange (request processed with failure)	FF hex	General communication error

NOTE: ENO parameter is set to 1 on a correct exchange.

CTRLSTAMP Parameter Description

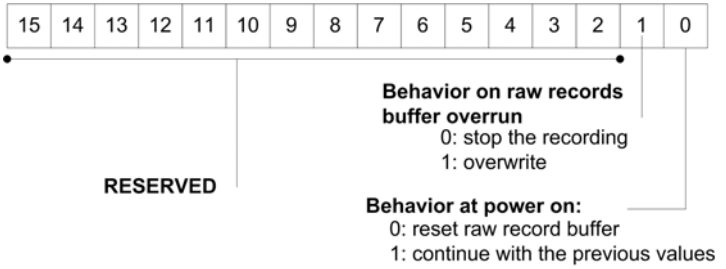
CTRL_STAMP DDT structure example and link with the PLC buffer:



The example above shows the CTRL_STAMP content after writing 32 events (1 event entry is 6 words long) in the PLC buffer configured as follows:

- PLC buffer is located on %MW100 and there are 32 events to write
- Stop the recording when the buffer is full and continue with the previous value on power on.

Operating MODE word structure:


15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Behavior on raw records buffer overrun
0: stop the recording
1: overwrite
RESERVED
Behavior at power on:
0: reset raw record buffer
1: continue with the previous values

Buffer level:

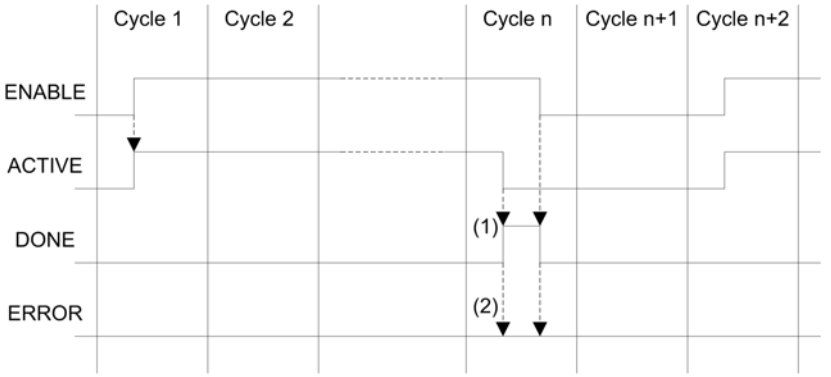
- If BEGIN Index = END Index then the buffer is empty
- If END Index + 6 = BEGIN Index then the buffer is full (in the preceding equation, 6 represents the size of 1 event). The buffer is full when there is one space left for 1 event (6 x INT).

EFB behavior on buffer full depends on the Operating MODE parameter, bit 1 value:

- If **Behavior on raw records buffer overrun** is set to 0 (stop the recording), the buffer is not filled with new data.
- If **Behavior on raw records buffer overrun** is set to 1 (overwrite buffer), elder data or overwritten with newer data. In this case, the EFB updates both BEGIN Index and END Index.

Operating Mode of Enable, Active, Done and Error Parameters

The ENABLE, ACTIVE, DONE (or SUCCESS) and ERROR parameters operate as follows:



(1) DONE = 1 if no error, DONE = 0 if error
(2) ERROR = 0 if no error, ERROR = 1 if error

The ENABLE parameter is written by the application.

The ACTIVE, DONE and ERROR parameters are read by the application.

To launch the communication function only once, the ENABLE signal needs to be reset to 0 once the ACTIVE parameter is set to 0. If the ENABLE parameter is maintained to 1 once the ACTIVE parameter is set to 0, the communication function is launched again and the ACTIVE parameter will be set to 1 on the next cycle.

2.4 Counter Function

Counter Function

Overview

Besides the basic counting functions, the following sub-functions are also available:
- Debounce filter
- Dechatter filter
- Enable
- Edge detection
- Supply monitor

Counting Process

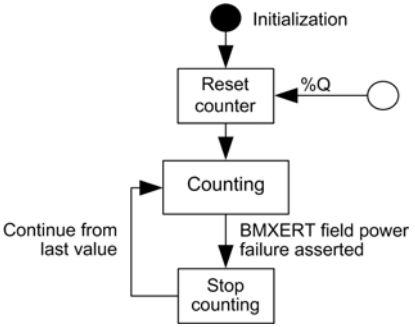
This function provides a simple incremental counter with reset function. If **Both Edge** option is selected, both rising and falling edges will be counted.

Refer to the General Specifications *(see page 63)* of counter function.

Parameter Type	Symbol	Valid Values	Description
`Implicit`	Channel *x* counter value (x = 0...15)	0...4294967295	Available in: Device DDT IODDT Debug screen
`Implicit`	Channel *x* clear counter value (x = 0...15)	A rising edge from 0 to 1 clears the counter	Available in: Device DDT IODDT Debug screen

NOTE: The counter value is volatile after backplane power down. The last counter value can be stored by user application.

Counter



Counter steps description:

Initialization: Initialization is performed on following conditions:

- After application or configuration download of the BMX ERT 1604 T module (including hot swap).
- Recovery after communication loss with CPU or BMX CRA 312 10.

Stop counting: The module only stops the counting after the field power failure is asserted.

Applications

3

Overview

This chapter describes different applications used in this BMX ERT 1604 T module.

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Application Areas	48
Typical Applications	49

Application Areas

BMX ERT 1604 T Application Areas

The following areas of application are valid for the BMX ERT 1604 T module:

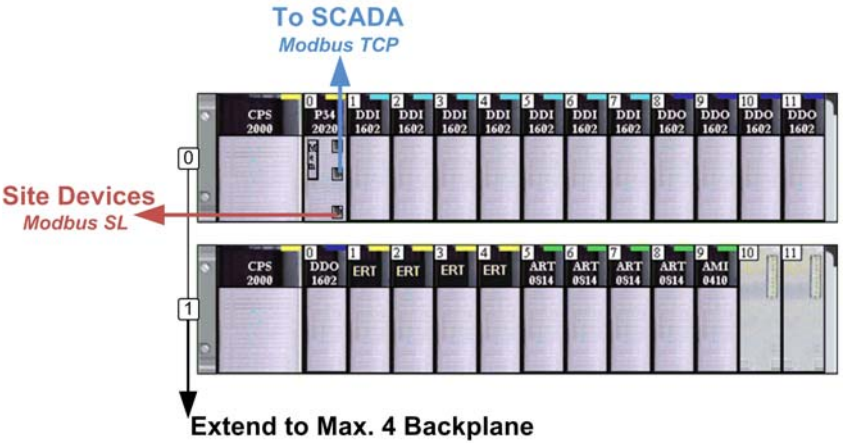
- Processing discrete input: Use as a standard input module with filtering in the range of 24...125 Vdc.
- Event time stamping: The event of an individual process status can be logged with the corresponding time (time stamp). Time stamping provides information that allows you to observe and evaluate the sequence of events in your process.
- Counter value: Use as a standard I/O module (with filtering, 32-bit summing with maximum 500 Hz) with an input range of 24...125 Vdc.
- Periodic time stamping of process values: Recording counter values in defined time intervals. The combined use of both function groups can be used as an advantage.
- Time dependent switching actions: The input modules can be set regardless of time for controlling lighting, heating, ventilators, temperatures (building automation), or for opening/closing doors, and machines (safety measures). The output status can be recorded with the ERT.

Typical Applications

M340 Standalone Configuration

This architecture is designed to target the medium and small capacity hydro turbine control with the following features:

- Power supply, DI and DO in 24 Vdc
- 8-channel RTD signal acquisition module
- Time stamping module with 1 ms resolution
- Modbus RS-485 communication with local serial line devices
- Modbus TCP Ethernet communication between LCU (Local Control Unit) and SCADA

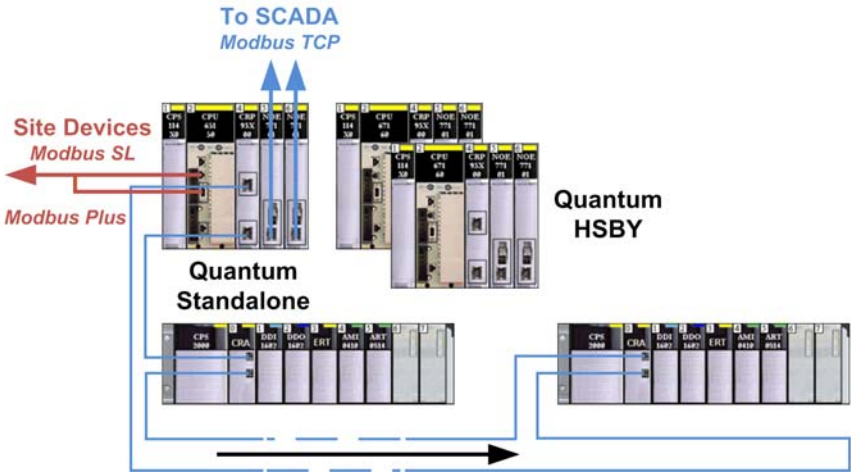


M340 RIO Configuration

This architecture is designed to target the requirements of HSBY system in medium capacity hydro turbine control. It is also used to protect =S= leadership position in big capacity hydro turbine control market.

This architecture has the following features:

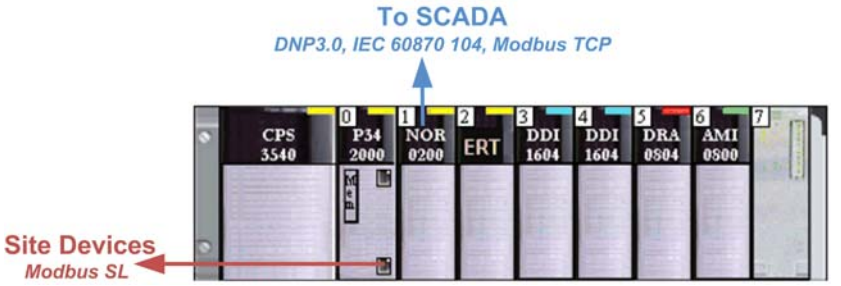
- Standalone Quantum CPU or HSBY Quantum CPU head
- Bumpless switch over when HSBY system required, which has the same performance as the Quantum S908 HSBY system
- Power supply, DI and DO in 24 Vdc
- 8-channel RTD signal acquisition module
- Time stamping module with 1 ms resolution
- Modbus RS-485 or Modbus Plus communication with local serial line devices
- Dual Modbus TCP Ethernet communication between LCU (Local Control Unit) and SCADA



M340 RTU Configuration

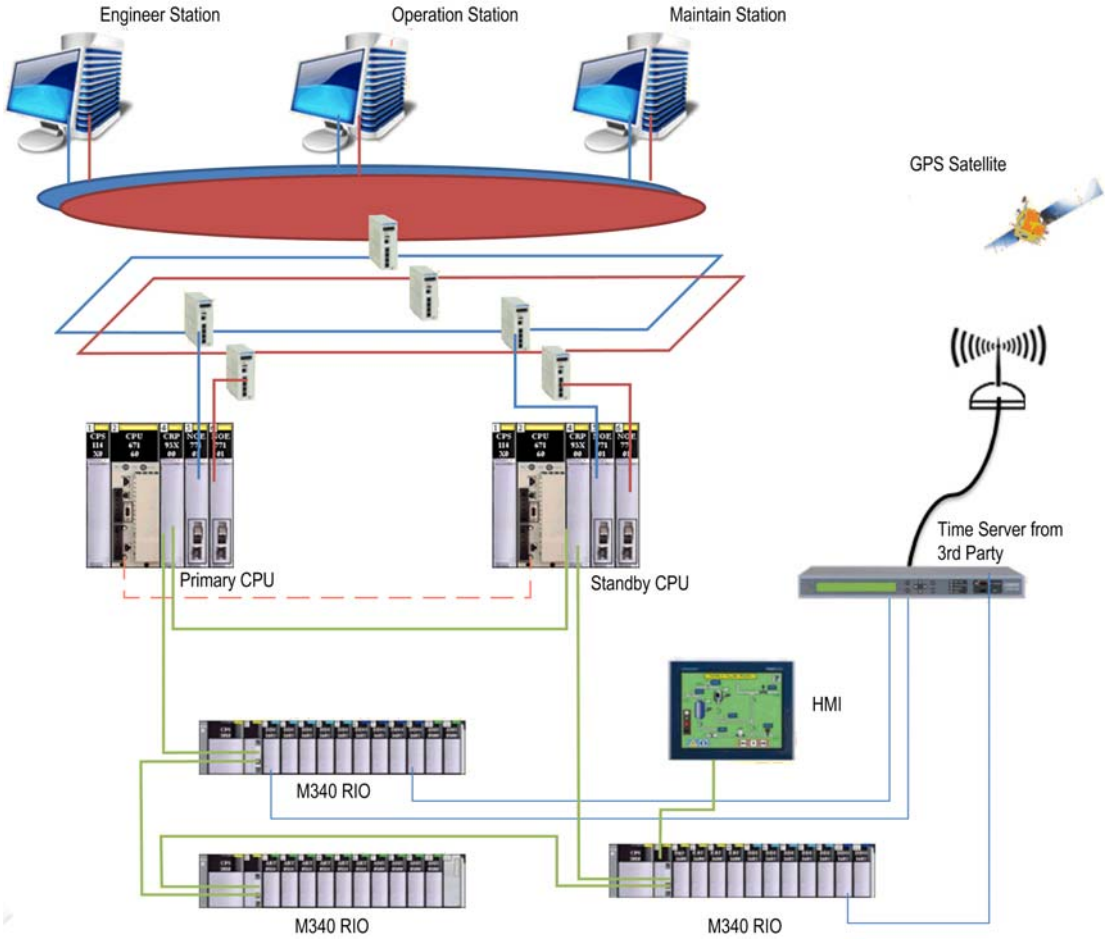
This architecture is designed to target the substation RTU applications with following features:

- Power supply, DI and DO range from 24...125 Vdc (the modules from Apollo project have supported the voltage range from 88 to 150 Vdc)
- Time stamping module with 1 ms resolution
- IEC 611131-2 zone C and IEC 61000-6-5 certification
- Modbus RS-485 or Modbus communication with local serial line devices
- RTU protocol supported with DNP 3.0, IEC 60870-5-101, IEC 60870-5-104, and Modbus TCP



External Time Synchronization

The external time synchronization from 3rd party time server is the single precise time source for each PLC system. The synchronized time sever distributes the time signal to each BMX ERT 1604 T module separately.



Physical Implementation

II

Overview

This part provides physical implementation of the BMX ERT 1604 T module.

What Is in This Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
4	Module Description	55
5	Guidelines for the Physical Installation	67

Module Description

4

Overview

This chapter provides general information on presentation, mounting, specification, and wiring of the BMX ERT 1604 T module.

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Overview	56
Field Wiring	57
Diagnosis	60
Technical Data	62

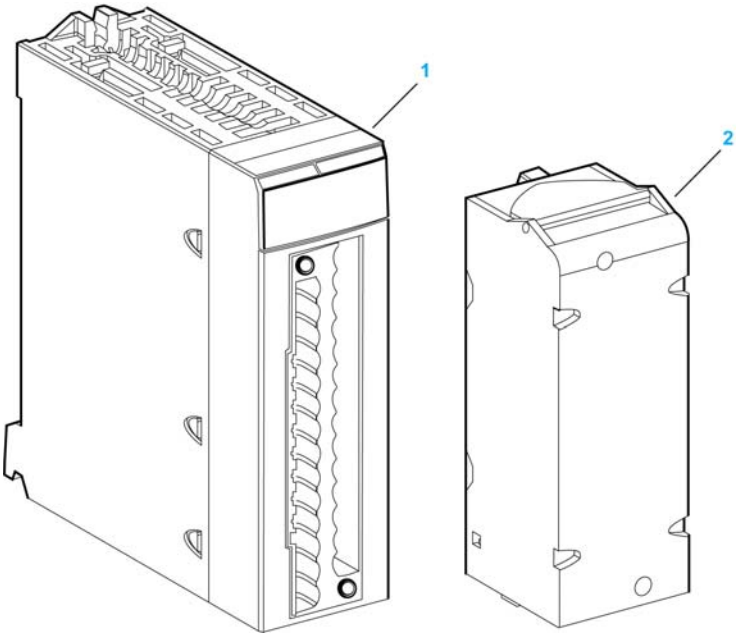
Overview

Introduction

The BMX ERT 1604 T module is a multifunction expert module with 16-channel discrete input.

This module is suitable for the evaluation of discrete input, counter pulses, and events.

Front View of the Module



1 Module
2 28-pin removable terminal block (provided separately)

Field Wiring

Overview

The BMX ERT 1604 T module uses one 28-pin terminal block (BMXFTB2820 or BMXFTB2800). This section describes the terminal pinning and wiring examples.

Field Sensors

The 16-channel discrete input support sensor signals from mechanical switching devices (operating in normal environmental conditions) such as relay contacts, limit switches, push buttons, 3-wire and 2-wire proximity switches.

The sensor interface of BMX ERT 1604 T module is designed base on the following rules:

Rank	Input Type
24 Vdc	IEC type 2
48 Vdc	IEC type 3
60 Vdc	
110 Vdc	U_{OFF}(max) = 22 V; U_{ON}(min) = 79 V; U_{ON}(max) = 138 V I_{OFF}(max) = I_{ON}(min) = I_{ON}(max) ≈ 1.2 mA
125 Vdc	U_{OFF}(max) = 25 V; U_{ON}(min) = 91 V; U_{ON}(max) = 156 V I_{OFF}(max) = I_{ON}(min) = I_{ON}(max) ≈ 1.25 mA

Time Code Sources

IRIG-B 000: The module receives external time codes in the IRIG-B 000 format through terminal block.

For detailed description of IRIG-B 000 format, refer to the *IRIG Standard 200-04*.

The physical signal of the time receiver output must be 5 Vdc differential type.

The specifications for the external transmitter are as follows:

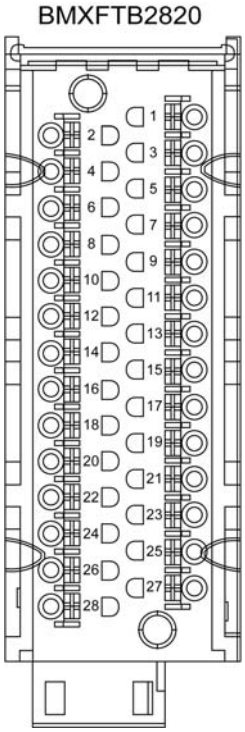
- 1 external source is allowed to drive up to 32 BMX ERT 1604 T modules.
- The minimum required level is 200 mV to activate the BMX ERT 1604 T module.
- IEEE1344 or IEEE C37.118 standard extension definition for DST information must be supported in order to maintain time accuracy during the switch between daylight saving time and standard time.

DCF77: The module receives external time codes in the DCF77 format through terminal block.
For detailed description of DCF77 format, refer to the *DCF77* standard.
The required output level from external DCF77 source is 24 Vdc and follows the rules as such:

- The transition level between mark and space is about 13 Vdc
- The current consumption is about 3.6 mA (at 24 Vdc) for the DCF77 input port of each module
- 1 external source is allowed to be wired to multiple modules (the upper limit depends on the current capability of the source)

Terminal Block Definition

The following figure shows the BMXFTB2820 terminal block.



The following table defines the pinouts on the terminal blocks:

Definition	Pin Number		Definition
DCF_IN	2	1	IRIG+
DCF_COM	4	3	IRIG-
NC	6	5	NC

Definition	Pin Number		Definition
I1	8	7	I0
I3	10	9	I2
I5	12	11	I4
I7	14	13	I6
I9	16	15	I8
I11	18	17	I10
I13	20	19	I12
I15	22	21	I14
NC	24	23	NC
UB+	26	25	0 Vdc
UB+	28	27	0 Vdc

⚠ WARNING

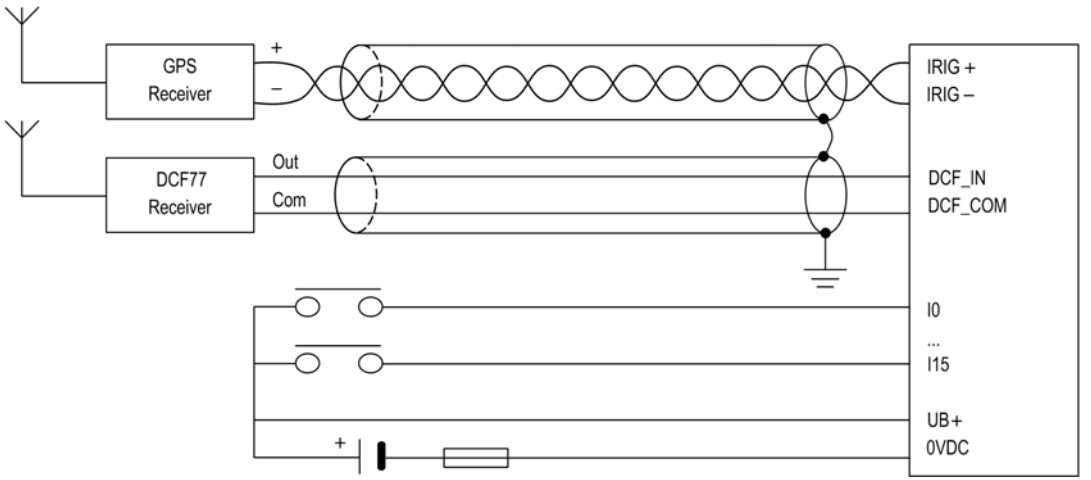
UNEXPECTED BEHAVIOR OF APPLICATION

The wrong wiring will cause death, serious injure, or equipment damage.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Wiring Diagram

The following figure shows the wiring diagram of the BMX ERT 1604 T module.



Diagnosis

Overview

The LED panel is used to indicate the basic module status, the state of 16-channel discrete input, and the state of the time code synchronization.

The 4 LEDs **RUN**, **ERR**, **I/O**, and **T** are on the top of the panel.

LED Indicators

The following figure shows the LED indicators of the BMX ERT 1604 T module.

The 00...15 LED indicate the input states of 16-channel discrete input. The **T** LED indicates the status of time code input. The **T** LED and the **RUN** LED indicate the downloading state during the firmware downloading phase.

Description of Indication Pattern

The following table describes the LED indicators:

RUN	ERR	IO	T	00...15	Meaning
OFF					The module is not receiving power or inoperable
OFF	ON	OFF			The module is not operational
OFF	BLK	OFF	OFF		The module is not configured or is configuring its channels
ON	BLK	OFF	X		Module has lost communication with CPU
ON	OFF	ON	X	BLK	Field power supply interruption
BLK	OFF	OFF	BLK	X	Downloading firmware
ON	X	X	OFF	X	No external time code input
ON	X	X	FLK	X	External time code is temporarily unstable but internal time quality is acceptable
ON	X	X	ON	X	Module clock synchronized with external time code
ON: LED is on. OFF: LED is off. FLK: The LED is on faster flashing (flickering). BLK: The LED is slower flashing (blinking). X: Do not care.					

RUN	ERR	IO	T	00...15	Meaning
ON	OFF	OFF	X	ON	The logical input **1** present on the corresponding channel

ON: LED is on.
OFF: LED is off.
FLK: The LED is on faster flashing (flickering).
BLK: The LED is slower flashing (blinking).
X: Do not care.

Technical Data

Compatibility

BMX CPU

Architecture	CPU Reference	Maximum Expert Channels/CPU	Maximum Number BMX ERT Modules/CPU
Local Architecture	BMX P34 1000	20	4
	BMX P34 2000	36	8
	BMX P34 2010	36	8
	BMX P34 20102	36	8
	BMX P34 2010	36	8
	BMX P34 2030	36	9
	BMX P34 20302	36	9

NOTE: 1 expert channel = 1 ERT logical group.

NOTE: For CPUs with a Modbus port, 1 expert channel is occupied by Modbus.

⚠ CAUTION

UNEXPECTED BEHAVIOR OF APPLICATION

In BMX CPU configuration, use the ERT module with OS2.5 or later.

Failure to follow these instructions can result in injury or equipment damage.

BMX CRA

Architecture	CRA Reference	Maximum Expert Channels/CRA	Maximum Module Number/Drop (CRA)	Maximum Module Number/ERIO Network
Remote I/O Architecture	BMX CRA 312 10	36	9	25

NOTE: 1 expert channel = 1 ERT logical group.

General Specifications

Hot Swapping Supported		Yes
Event Sampling Rate		0.5 ms
Time Stamp Resolution		1 ms
Time Input Synchronizing Duration	IRIG-B	<3 s
	DCF77	<3 min
Maximum Event Buffer Capability		255 groups (Note2)
Event Data Protection (power-down)		Yes (Non-volatile)
Maximum Event Buffer Capability	Per UMAS Request	20 events
	Per EFB Request	20 events
Minimum Timeout Setting Between Reading Requests	Between UMAS Requests	5 ms
	Between EFB Requests	5 ms
Max Event Burst Within 1 s Without Buffer Being Full	Local (with 5 ms interval between requests)	4000 events/s
	RIO network (With Max BMXERT modules) (Max 16 reading requests/PLC cycle)	500 events/s (PLC cycle = 100 ms)
Counting Function	Counter Bits	32 bits
	Maximum Frequency	500 Hz
Backplane Power Consumption	+ 3.3 Vdc	130 mA
	+ 24 Vdc	30 mA
Isolation	Bus to discrete Input	2500 Vdc @ 1 min
	Bus to IRIG/DCF	1400 Vdc @ 1 min
	Discrete Input to IRIG/DCF	2500 Vdc @ 1 min

NOTE: The calibration approach is required to achieve this accuracy. The calibration takes 2 times of successful external synchronization to warm up. (The normal interval between each synchronization is 1 s for IRIG-B and 1 min for DCF77).

NOTE: The event number contained in one group varies within 1...16. It depends on how many channels get the events occurred within same sampling window (that is, 0.5 ms).

Discrete Input

Data of the process inputs:

Channel Number		16	
Group Organization		4 logical groups (not isolated from each other)	
Available Voltage Ranks		24 Vdc, 48 Vdc, 60 Vdc, 110 Vdc, and 125 Vdc	
Input Type of IEC61131-2	24 Vdc		Type 2
	48 Vdc and 60 Vdc		Type 3
	110 Vdc and 125 Vdc		Not applicable
24 Vdc	At 1	Voltage	11...30 V
		Current	≈ 6.7 mA
	At 0	Voltage	< 5 V
		Current	< 2.9 mA
48 Vdc	At 1	Voltage	30...60 V
		Current	≈ 2.5 mA
	At 0	Voltage	< 10 V
		Current	< 2.5 mA
60 Vdc	At 1	Voltage	39...75 V
		Current	≈ 2.5 mA
	At 0	Voltage	< 12 V
		Current	< 2.5 mA
110 Vdc	At 1	Voltage	79...138 V
		Current	≈ 1.3 mA
	At 0	Voltage	< 22 V
		Current	< 1.3 mA
125 Vdc	At 1	Voltage	91...156 V
		Current	≈ 1.3 mA
	At 0	Voltage	< 25 V
		Current	< 1.3 mA
Maximum Input Voltage			156 Vdc
Reverse Protection			Yes (-156 Vdc maximum)
Maximum Refreshing Rate			0.5 ms
Input Filter Response			0...255 ms (configurable)

Field Power Supply

Data of the field power supply:

Allowed Supply Range	24 Vdc	19...30 V
	48 Vdc and 60 Vdc	38...75 V
	110 Vdc and 125 Vdc	88...156 V
Power Failure Threshold	24 Vdc	≈ 17 V
	48 Vdc and 60 Vdc	≈ 34 V
	110 Vdc and 125 Vdc	≈ 82 V
	Performance	Power failure thresholds are always higher than 0/1 thresholds of discrete input
Supply Current	At all ranks	< 1 mA

NOTE: The voltage level of field power supply must be consistent with what is selected in the configuration interface.

Power Dissipation

Item	**Description**	
Module Power Dissipation	All channels with high level inputs (for all the ranks)	4 W

Time Code Inputs

Data of the time code inputs:

IRIG-B	IRIG format	IRIG-B 000
	Bit rate	100 pps
	Index count interval	10 ms
	Modulation	Pulse width code
	Carrier	No
	Coded expression	BCD_{TOY}, BCD_{YEAR}, CF, and CBS
	Physical signal	5 Vdc differential (RS-485 type)
	Mark condition	V_A-V_B > 200 mV
	Space condition	V_B-V_A > 200 mV
	Maximum rating	±10 V
	Transmitter sharable	Upto 32 modules

DCF77	Bit rate	1 pps
	Index count interval	1000 ms
	Modulation	Pulse width code
	Carrier	No
	Coded expression	BCD
	Physical signal	24 Vdc single-ended
	Mark space threshold	≈ 13 V
	Input current	≈ 3.6 mA
	Maximum rating	±30 V
	Transmitter sharable	Sharing number = Source capability/3.6 mA

⚠ CAUTION

UNEXPECTED BEHAVIOR OF APPLICATION

Wiring a DCF77 source wrongly to IRIG-B port will damage the BMX ERT 1604 T module.

Failure to follow these instructions can result in injury or equipment damage.

Environmental Specifications

All parts are designed:

- for the operating range of -25...70 °C (-13...158 °F)
- to operate at an altitude up to 4000 m (13123 ft)

Guidelines for the Physical Installation

5

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Installing the BMX ERT 1604 T Module	68
Fitting 28-pin Terminal Blocks	70
Connecting 28-pin Terminal Block	74
Accessories	77

Installing the BMX ERT 1604 T Module

Overview

The BMX ERT 1604 T module is powered by the backplane bus. The modules may be handled without turning off power supply to the rack, without causing any danger and without any risk of damage or disturbance to the PLC.

The fitting operations (installation, assembly, and disassembly) are described as follows.

Installation Precautions

Before installing a module, take off the protective cap from the module connector located on the backplane.

⚠ DANGER

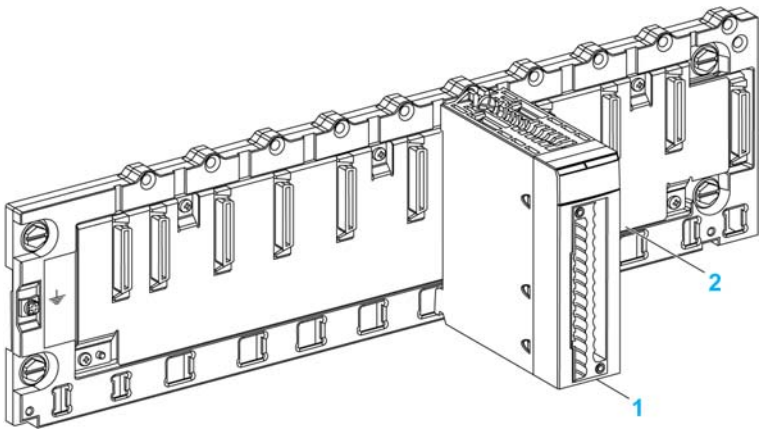
ELECTRICAL SHOCK

- If the terminal block is connected to a shield bar while mounting/removing the modules, make sure that the terminal block is still connected to the shield bar.
- Remove the power to the sensors and pre-actuators.
- Disconnect the terminal blocks.

Failure to follow these instructions will result in death or serious injury.

Installation

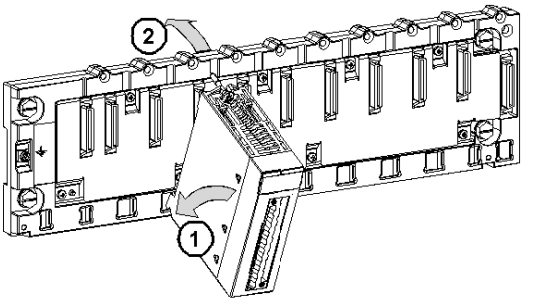
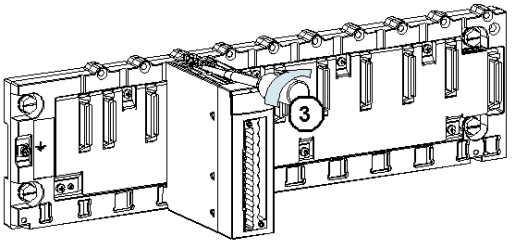
The following figure shows the BMX ERT 1604 T module mounted on the rack.



1 BMX ERT 1604 T module
2 Standard rack

Installing the Module on the Rack

The following table describes the procedure for mounting the counting modules in the rack:

Step	Action	Illustration
1	Position the locating pins situated at the rear of the module (on the bottom part) in the corresponding slots in the rack.	Steps 1 and 2 
2	Swivel the module towards the top of the rack so that the module sits flush with the back of the rack. It is now set in position.	
3	Tighten the safety screw to ensure that the module is held in place on the rack. Tightening torque: Maximum 1.5 N•m	Step 3 

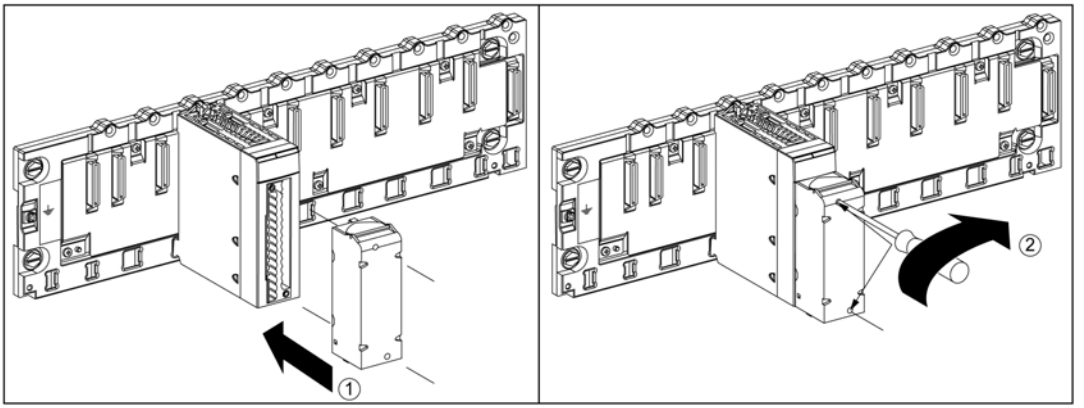
Fitting 28-pin Terminal Blocks

Overview

BMX ERT 1604 T module with 28-pin terminal block connection requires terminal block to be connected to the module. These fitting operations (assembly and disassembly) are described below.

Installing the 28-pin Terminal Block

The following figure shows the procedure for assembling the 28-pin terminal block onto a BMX ERT 1604 T module.



The following table describes the assembly procedure of the 28-pin terminal block onto a BMX ERT 1604 T module:

Step	Action
1	Once the module is in place on the rack, install the terminal block by inserting the terminal block encoder (the rear lower part of the terminal) into the module's encoder (the front lower part of the module), as shown above.
2	Fix the terminal block to the module by tightening the 2 mounting screws located on the lower and upper parts of the terminal block. Tightening torque: 0.4 N•m (0.30 lb-ft).

NOTE: If the screws are not tightened, there is a risk that the terminal block will not properly fix to the module.

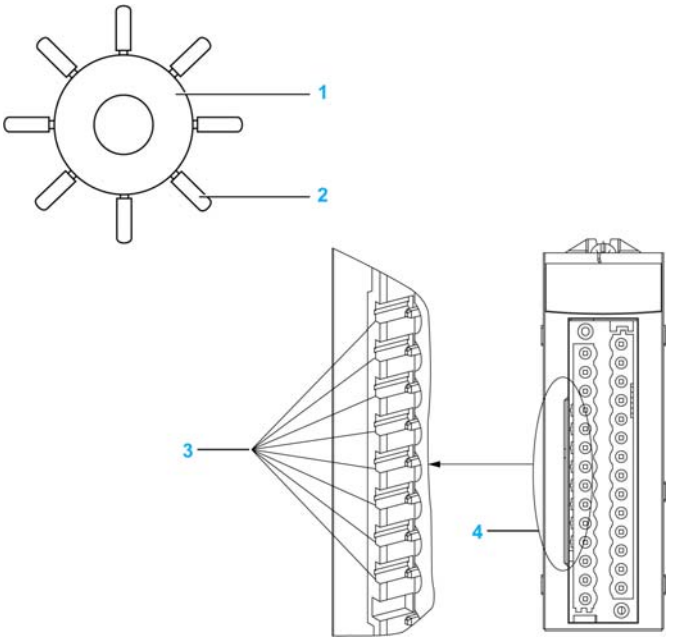
Coding the 28-Pin Terminal Block

When a 28-pin terminal block is installed on a module dedicated to this type of terminal block, you can code the terminal block and the module using studs. The purpose of the studs is to prevent the terminal block from being mounted on another module. Incorrect insertion can be avoided when replacing a module.

Coding is done by the user with the STB XMP 7800 guidance wheel's studs. You can only fill the 6 slots in the middle of the left side (as seen from the wiring side) of the terminal block, and can fill the module's 6 guidance slots on the left side.

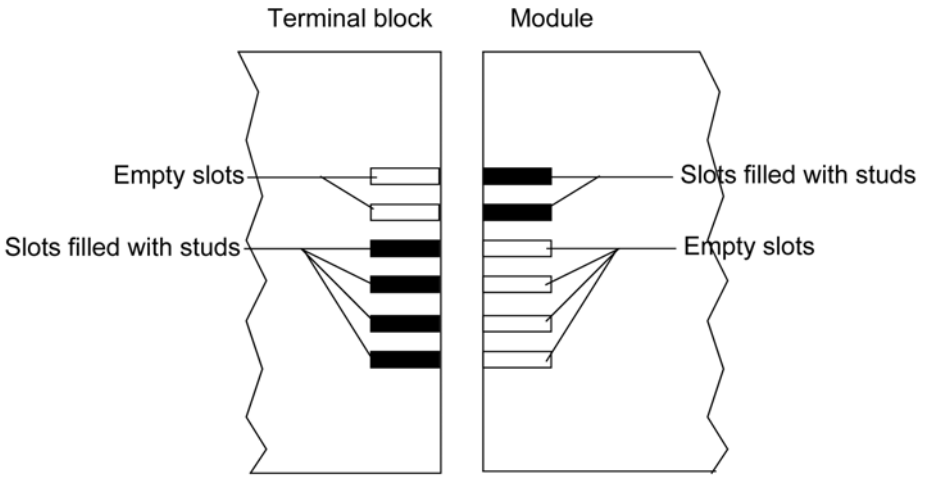
To fit the terminal block to the module, a module slot with a stud must correspond to an empty slot in the terminal block, or a terminal block with a stud must correspond to an empty slot in the module. You can fill upto and include any of the 6 available slots as desired.

The following diagram shows a guidance wheel and the slots on the module used for coding the 28-pin terminal blocks.

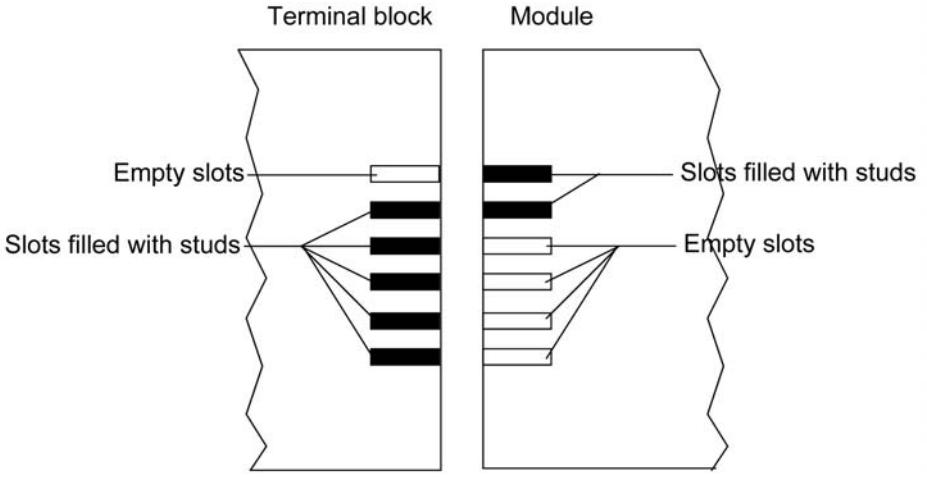


1 Guidance wheel
2 Detachable stud
3 Guidance slots
4 Module slots

The following diagram shows an example of a coding configuration that makes it possible to fit the terminal block to the module.



The following diagram shows an example of coding configuration with which it is not possible to fit the terminal block to the module.



⚠ DANGER

ELECTRICAL SHOCK

Remove the sensor and pre-actuator voltage before connecting or disconnecting the terminal block.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

UNEXPECTED BEHAVIOR OF APPLICATION

Code the terminal block as described above to prevent the terminal block from being mounted on another module.

Plugging the wrong connector could cause unexpected behavior of the application.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

⚠ CAUTION

DESTRUCTION OF THE MODULE

Code the terminal block as described above to prevent the terminal block from being mounted on another module.

Plugging the wrong connector could cause the module to be destroyed.

Failure to follow these instructions can result in injury or equipment damage.

NOTE: The module connector has indicators which show the proper direction to use for terminal block installation.

Connecting 28-pin Terminal Block

Overview

The BMX ERT 1604 T module uses the 28-pin removable terminal block.

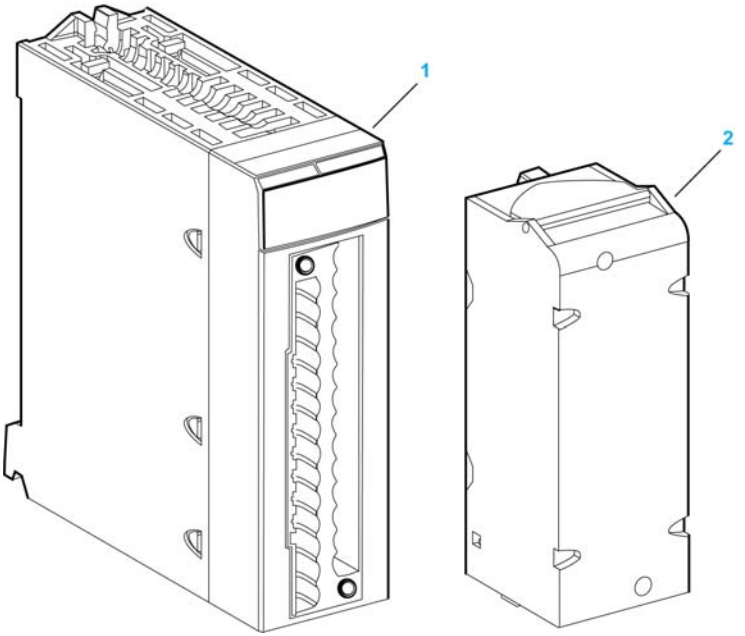
There are 2 types of 28-pin terminal blocks:
- BMXFTB2800 caged terminal blocks
- BMXFTB2820 spring terminal blocks

Cable Ends and Contacts

Each terminal block can accommodate:
- Solid core wire
- Flexible stranded wire
- Wire with DZ5-CE type cable ends

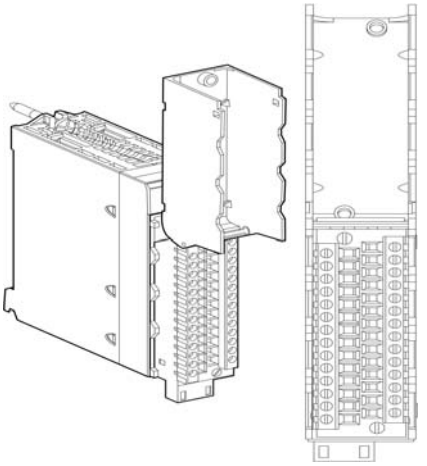
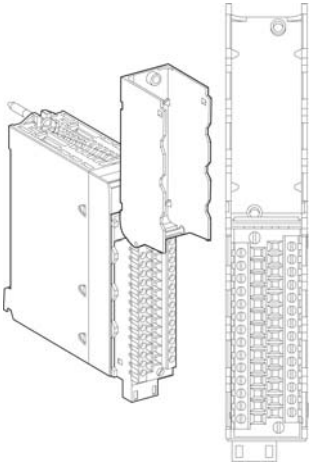
Description of the 28-pin Terminal Block

The following figure shows the BMX ERT 1604 T module and 28-pin removable terminal block.



1 Module
2 28-pin removal terminal block

The following table describes the characteristics of the BMX ERT 1604 T terminal block:

Illustration		**Caged Terminal Blocks**	**Spring Terminal Blocks**
–			
Number of wires accomodated		1	1
Number of wire gauges accommodated	minimum	AWG 24 (0.34 mm^2)	
	maximum	AWG 16 (1.5 mm^2)	
Wiring constraints		Caged terminal blocks have slots that accept flat-tipped screwdrivers with a diameter of 3 mm, and also have captive screws. On the supplied blocks, these screws are not tightened.	To insert and remove wires from the connectors, use a 2.5 x 0.4 mm screwdriver to open the round receptacle by pushing on the corresponding plate. Push the flexible plate down on the outside (the side closest to the corresponding receptacle). A screwing (rotating) or bending motion is not required.
Maximum screw tightening torque		0.5 N•m (0.37 lb-ft)	–

⚠ DANGER

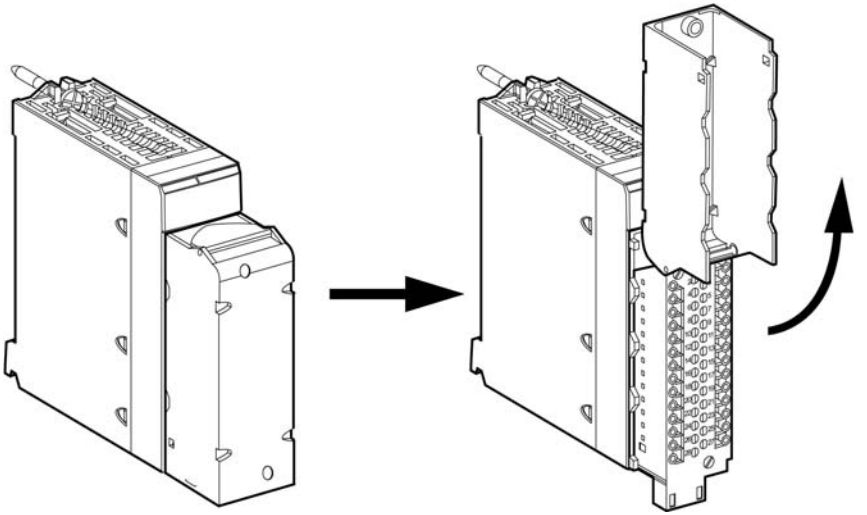
ELECTRICAL SHOCK

Remove sensor and pre-actuator voltage before connecting or disconnecting the terminal block.

Failure to follow these instructions will result in death or serious injury.

Connecting the 28-Pin Terminal Blocks

The following figure shows the method for opening the 28-pin terminal block door so that it can be wired.



NOTE: The connection cable is installed and held in place by a cable clamp positioned below the 28-pin terminal block

Labeling of 28-Pin Terminal Blocks

The labels for the 28-pin terminal blocks are supplied with the module. Where, you need to insert the terminal block cover. Each label has 2 sides:

- One side is visible from the outside when the cover is closed. This side features the commercial product references, an abbreviated description of the module, and a blank section for customer labeling.
- One side is visible from the inside when the cover is open. This side shows the terminal block connection diagram.

Accessories

The following table describes the accessories for the BMX ERT 1604 T module:

Commercial Reference	Description
BMX XSP 0400 BMX XSP 0600 BMX XSP 0800 BMX XSP 1200	EMC kit
BMXFTB2820	28-pin spring removable terminal block
BMXFTB2800	28-pin screw caged removable terminal block

BMX ERT 1604 T Software Implementation

III

Overview

This part provides software implementation and functions of BMX ERT 1604 T module.

The BMX ERT 1604 T module can work with the CPU modules of M340 family and work with the remote I/O adapter (CRA), which is connected to Quantum platform via Ethernet. The usage of BMX ERT 1604 T module in an Ethernet I/O (EIO) drop is different from the local application.

What Is in This Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
6	Configuration of BMX ERT 1604 T Module	81
7	Using BMX ERT 1604 T in a Modicon M340 Configuration	109
8	Using BMX ERT 1604 T in ERIO Drop	119

Configuration of BMX ERT 1604 T Module

6

Overview

This chapter describes the configuration of BMX ERT 1604 T module.

What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
6.1	Using BMX ERT 1604 T in Unity Pro	82
6.2	User Screen for BMX ERT 1604 T Module	84
6.3	Configuration Parameters for Channels	96
6.4	Configuration in Project Settings	106

6.1 Using BMX ERT 1604 T in Unity Pro

Inserting BMX ERT 1604 T in the Rack

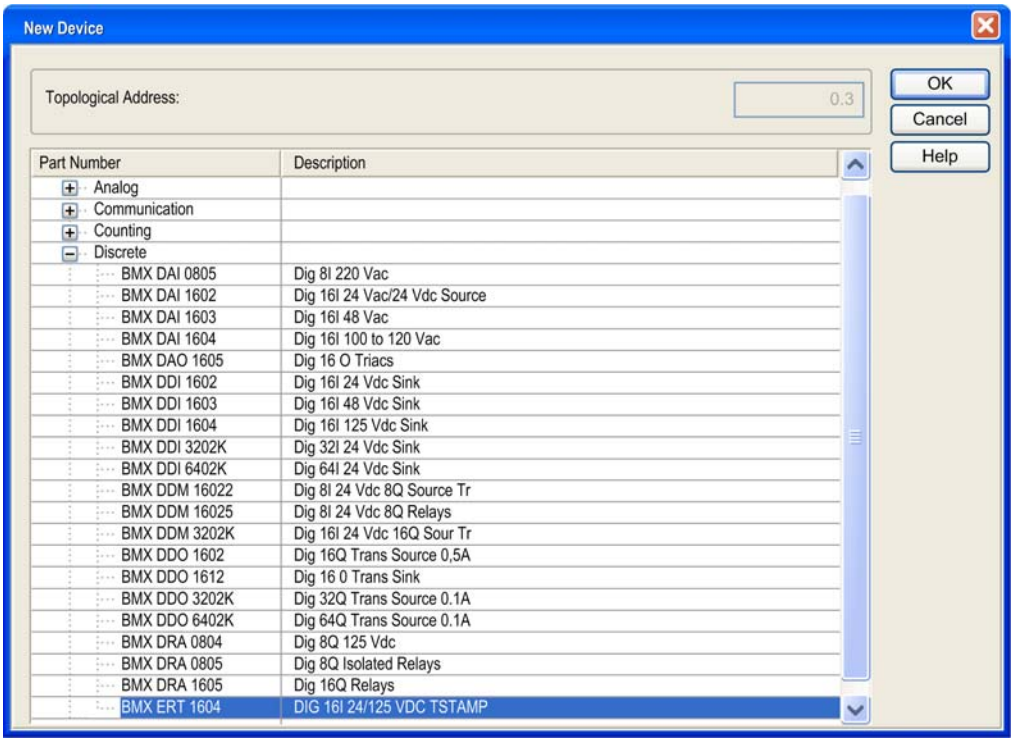
Versions Requirements

Component	Version
Unity Pro	V 7.0 or later
Modicon M340 processor	OS V2.5 or later

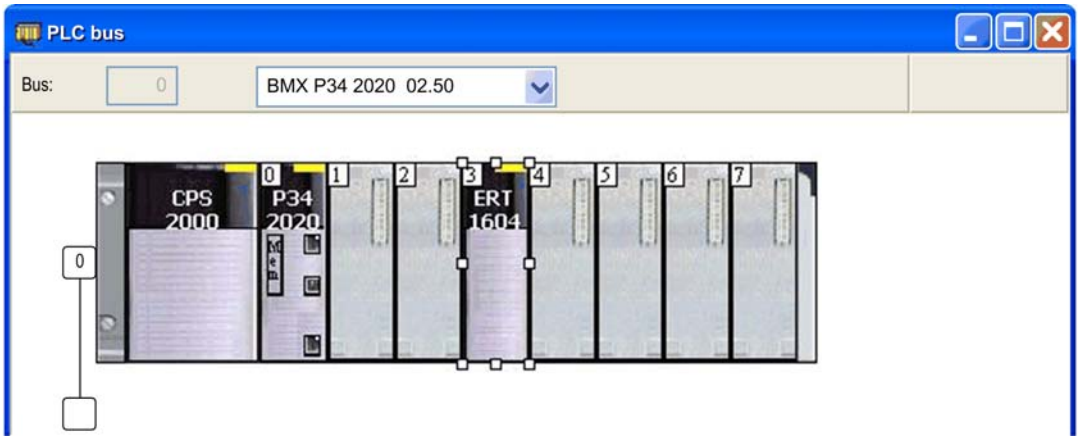
Overview

After creating an application with a Modicon M340 processor, the BMX ERT 1604 T module can be inserted into any available slot, except slot 0 on rack 0.

Select an available slot and click **New Device** to open the catalog. The BMX ERT 1604 T module is in **Discrete** family as displayed in the following figure.



The device fits in 1 slot in the rack.



6.2 User Screen for BMX ERT 1604 T Module

Overview

This section describes the configuration screen for BMX ERT 1604 T module.

What Is in This Section?

This section contains the following topics:

Topic	Page
User Screen Overview	85
Module Configuration	87
User Screen in Online Mode	89

User Screen Overview

Overview

To access the module screen, double-click the device bitmap in a slot and then click BMX ERT 1604 T. This displays a module zone which includes a general parameter zone and available tabs.

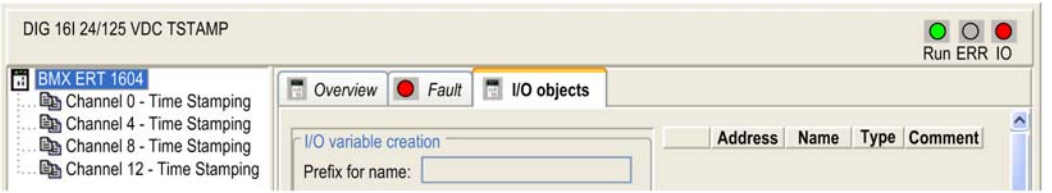
The general parameter zone displays the module name BMX ERT 1604 T on the left corner of the module screen.

The general parameter zone displays 4 secondary options allowing you to select the input group you want to configure:

- Channel 0...3 displayed as Channel 0
- Channel 4...7 displayed as Channel 4
- Channel 8...11 displayed as Channel 8
- Channel 12...15 displayed as Channel 12

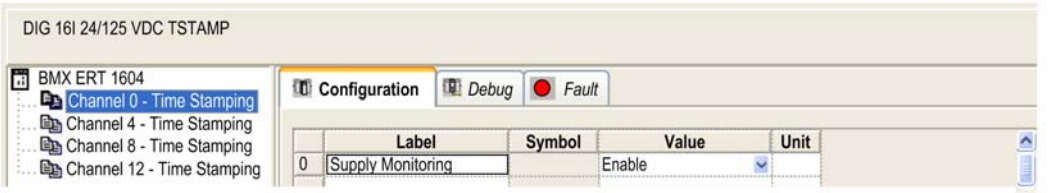
The 3 tabs available for the module are as follows:

- **Overview**
- **I/O objects**
- **Fault** (displayed only when module fault detected online)



The 3 tabs available for the channels (by group) are as follows:

- **Configuration**
- **Debug** (online/local rack only)
- **Fault** (displayed only when channel fault detected online)



Difference between in ERIO Drop and in Local

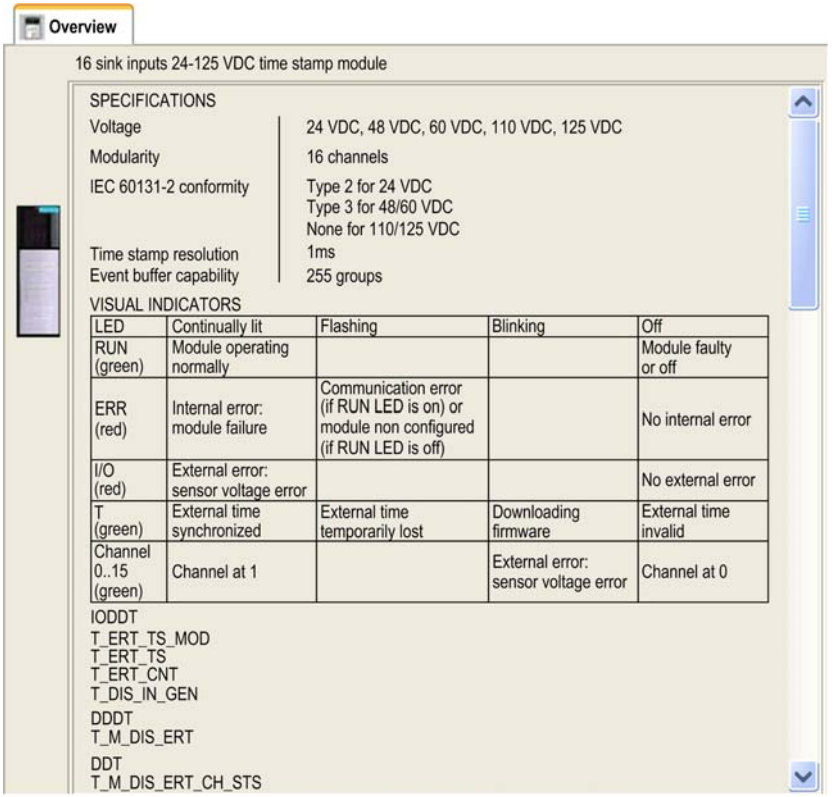
In a Quantum EIO application, the online display tabs are suppressed. Also, the **I/O objects** tab and **IODDT** are replaced by a device DDT.

The following table shows the different tabs accessed for the module configuration when it is used in a local M340 application and in a remote Quantum EIO application:

Item	Local Application	Quantum EIO Application
Offline and **Online**	**Overview**	**Overview**
	Configuration	**Configuration**
Online	**Debug**	–
	Fault	–
Object management	**I/O objects**	**Device DDT**
	IODDT	

Module Configuration

Overview Tab


Overview

16 sink inputs 24-125 VDC time stamp module

SPECIFICATIONS

Voltage	24 VDC, 48 VDC, 60 VDC, 110 VDC, 125 VDC
Modularity	16 channels
IEC 60131-2 conformity	Type 2 for 24 VDC Type 3 for 48/60 VDC None for 110/125 VDC
Time stamp resolution	1ms
Event buffer capability	255 groups

VISUAL INDICATORS

LED	Continually lit	Flashing	Blinking	Off
RUN (green)	Module operating normally			Module faulty or off
ERR (red)	Internal error: module failure	Communication error (if RUN LED is on) or module non configured (if RUN LED is off)		No internal error
I/O (red)	External error: sensor voltage error			No external error
T (green)	External time synchronized	External time temporarily lost	Downloading firmware	External time invalid
Channel 0..15 (green)	Channel at 1		External error: sensor voltage error	Channel at 0

IODDT
T_ERT_TS_MOD
T_ERT_TS
T_ERT_CNT
T_DIS_IN_GEN

DDDT
T_M_DIS_ERT

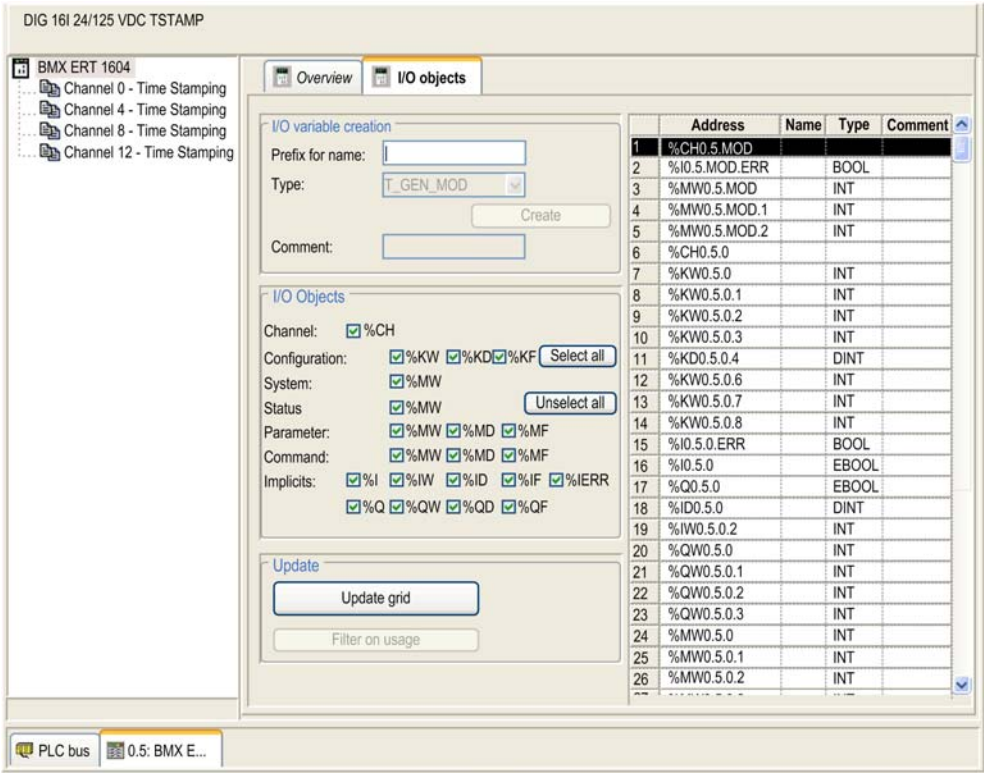
DDT
T_M_DIS_ERT_CH_STS

I/O Objects Tab

I/O objects tab displays objects, name, and an area for comment.

It allows you to manage I/O objects of the module by using the following functions:

- Display I/O objects with topological addressing
- Filter I/O objects
- Sort I/O objects
- Create an IODDT instance for the module
- Pre-symbolize a set of IODDT variables



NOTE: You can create and associate variables to objects, but cannot delete variables from this page.

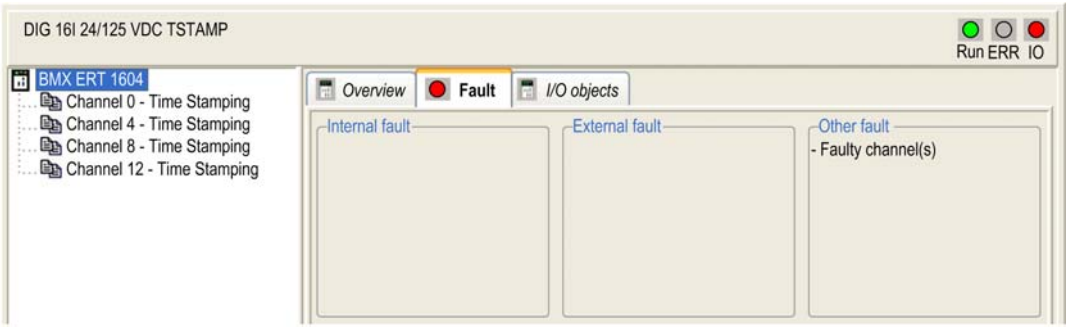
User Screen in Online Mode

Fault Tabs

The **Fault** pages display detected error status for the module and each channel.

Module Fault Tab

This tab is displayed when there is a detected error of the module, and a red dot is shown with the tab name.

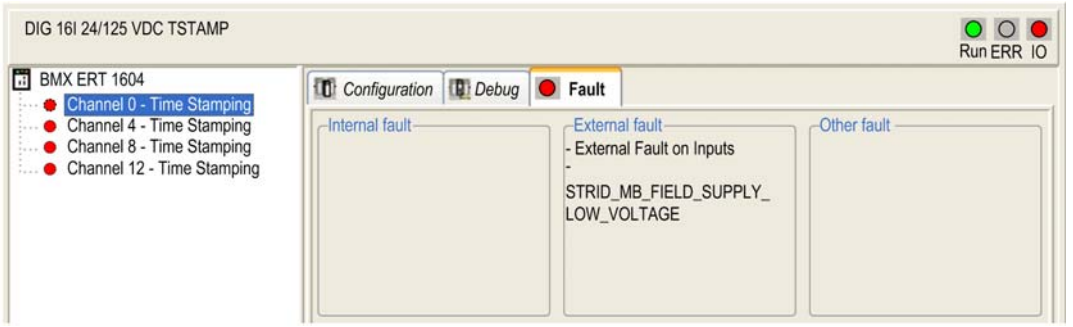


Module Fault Parameters:

Object	Type	Symbol	Description
%Ir.m.MOD.ERR	BOOL	MOD_ERROR	Module detected error bit
%MWr.m.MOD.2	INT	MOD_FLT	Internal detected error INT of the module
x0	BIT	MOD_FAIL	Internal detected error, module detected failure
x1	BIT	CH_FLT	Inoperative channels
x2	BIT	–	Unused
x3	BIT	–	Module in self tests
x5	BIT	CONF_FLT	Hardware or software configuration detected error
x6	BIT	NO_MOD	Module missing or off

Channel Fault Tab

This tab is displayed when there is a detected error of the channel, and a red dot is shown with the channel item.

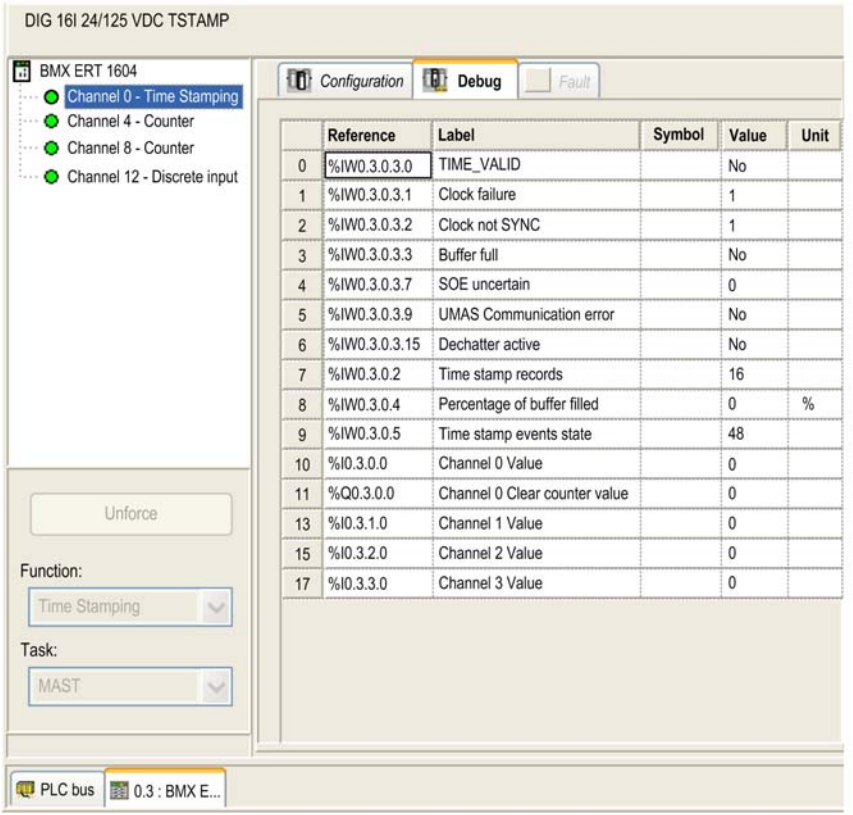


Channel Fault Parameters:

Type	Symbol	Description
EXTERNAL	CH_ERROR	External detected error on inputs
INTERNAL	INTERNAL_FLT	Inoperative channel
INTERNAL	CONF_FLT	Hardware or software configuration detected error
INTERNAL	COM_FLT	Module missing or off (detected error communication with PLC)
EXTERNAL	EXT_PWS_FLT	Power supply detected error for supply monitoring

Group 0 Debug Tab

Debug tab:



	Reference	Label	Symbol	Value	Unit
0	%IW0.3.0.3.0	TIME_VALID		No	
1	%IW0.3.0.3.1	Clock failure		1	
2	%IW0.3.0.3.2	Clock not SYNC		1	
3	%IW0.3.0.3.3	Buffer full		No	
4	%IW0.3.0.3.7	SOE uncertain		0	
5	%IW0.3.0.3.9	UMAS Communication error		No	
6	%IW0.3.0.3.15	Dechatter active		No	
7	%IW0.3.0.2	Time stamp records		16	
8	%IW0.3.0.4	Percentage of buffer filled		0	%
9	%IW0.3.0.5	Time stamp events state		48	
10	%I0.3.0.0	Channel 0 Value		0	
11	%Q0.3.0.0	Channel 0 Clear counter value		0	
13	%I0.3.1.0	Channel 1 Value		0	
15	%I0.3.2.0	Channel 2 Value		0	
17	%I0.3.3.0	Channel 3 Value		0	

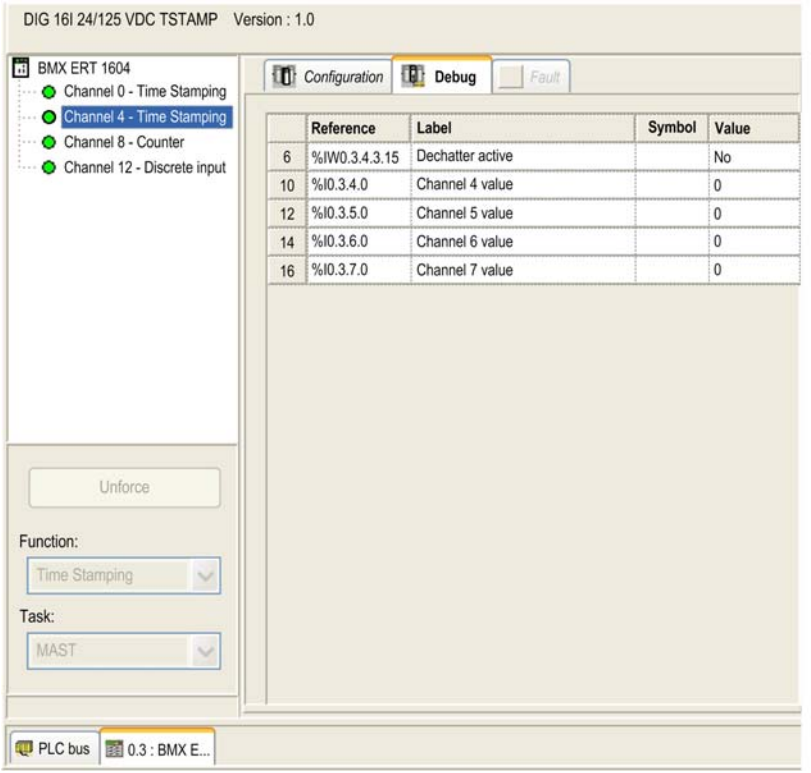
The parameters for the group 0 (channels 0...3) debug page are listed in the following table. Group 0 inputs are dedicated time stamping inputs, which cannot be reconfigured as counter or standard discrete input channels.

Object	Type	Label	Detail
%IWr.m.0.3	INT	–	TS_DIAGNOSTIC_FLAGS
%IWr.m.0.3.0	BOOL	TIME_VALID	Time OK and synchronized
%IWr.m.0.3.1	BOOL	Clock failure	Same as ClockFailure. Indication in the TimeQuality
%IWr.m.0.3.2	BOOL	Clock not SYNC	Same as ClockNotSynchronized. Indication in the TimeQuality
%IWr.m.0.3.3	BOOL	Buffer full	Buffer full

Object	Type	Label	Detail
%IWr.m.0.3.7	BOOL	SOE uncertain	Variable to assign an SOE uncertain Event ID
%IWr.m.0.3.9	BOOL	UMAS Communication error	<Module Parameter> UMAS communication error
%IWr.m.0.3.15	BOOL	Dechatter active	<Group Parameter> If any edges discarded by dechatter filter for any channels under this group.
%IWr.m.0.2	INT	Time stamps records	<Module Parameter> This word contains the number of Time Stamp records available in the module local buffer
%IWr.m.0.4	INT	Percentage of buffer filled	Percentage of the buffer filled [0...100]
%IWr.m.0.5	INT	Time stamp events state	Main state of the TS events service (reserved)
%Ir.m.0.0	EBOOL	Channel 0 value	Channel 0 input value
%Ir.m.1.0	EBOOL	Channel 1 value	Channel 1 input value
%Ir.m.2.0	EBOOL	Channel 2 value	Channel 2 input value
%Ir.m.3.0	EBOOL	Channel 3 value	Channel 3 input value
%Qr.m.0.0	EBOOL	Channel 0 Clear Counter value	<Module Parameter> Clear counter value

Group 1, 2 and 3 Time Stamping Debug Tab

Groups 1, 2 and 3 time stamping debug pages:



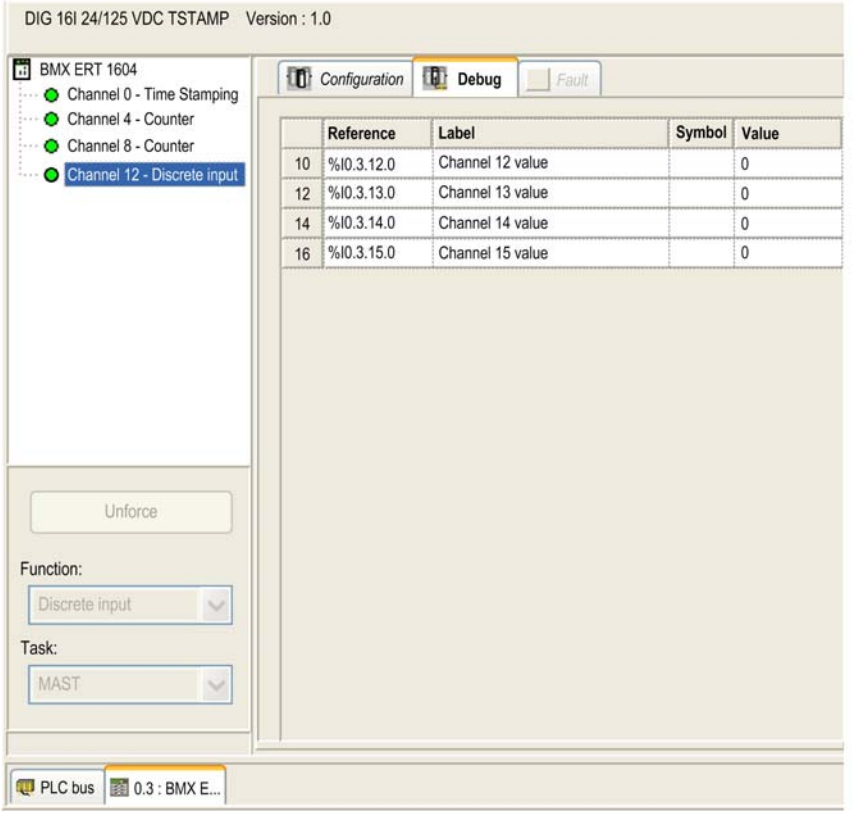
The time stamping parameters for the groups 1, 2, 3 debug page are listed in the following table:

Object	Type	Label	Description
%Ir.m.x.0	EBOOL	Channel *x* value	Channel *x* input value x = 4, 5, 6, 7 (group 1) or 8, 9, 10, 11 (group 2) or 12, 13, 14, 15 (group 3)
%IWr.m.x.3	INT	–	TS_DIAGNOSTIC_FLAGS x = 4, 8, 12
%IWr.m.x.3.15	BOOL	Dechatter active	<Group Parameter> If any edges discarded by dechatter filter for any channels under this group.

NOTE: x = channel 4, 5, 6, or 7 (group 1); channel 8, 9, 10, or 11 (group 2); channel 12, 13, 14, or 15 (group 3).

Group 1, 2 and 3 Discrete Input Debug Tab

Groups 1, 2 and 3 discrete input debug pages:



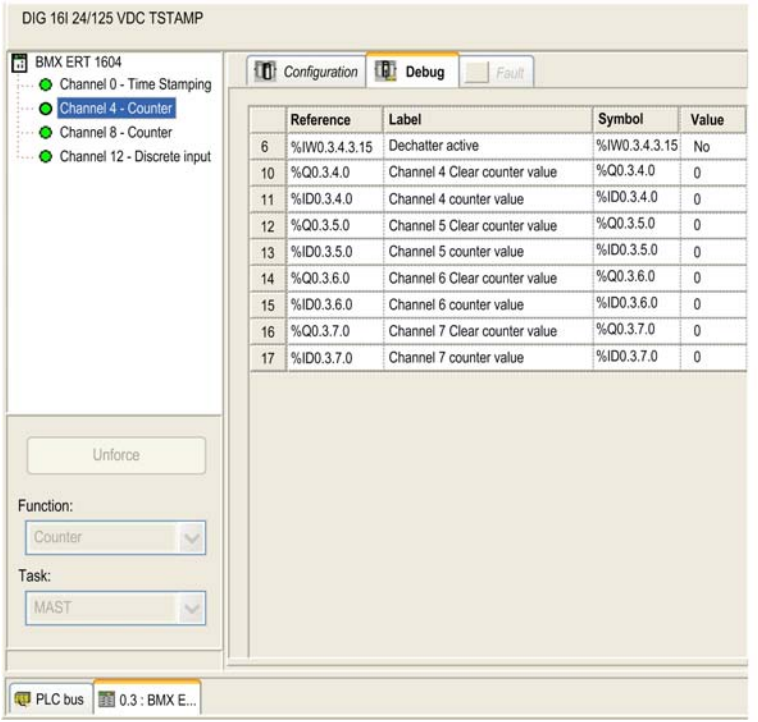
The standard discrete input (without time stamping) parameters for the group 1, 2, 3 debug page are listed in the following table:

Object	Type	Label	Description
%Ir.m.x.0	EB00L	Channel *x* value	Channel *x* input value

NOTE: x = channel 4, 5, 6, or 7 (group 1); channel 8, 9, 10, or 11 (group 2); channel 12, 13, 14, or 15 (group 3).

Group 1, 2 and 3 Counter Debug Tab

Groups 1, 2 and 3 counter debug pages:


DIG 16I 24/125 VDC TSTAMP
BMX ERT 1604
Channel 0 - Time Stamping
Channel 4 - Counter
Channel 8 - Counter
Channel 12 - Discrete input
Configuration
Debug
Fault
Reference
Label
Symbol
Value
6 %IW0.3.4.3.15 Dechatter active %IW0.3.4.3.15 No
10 %Q0.3.4.0 Channel 4 Clear counter value %Q0.3.4.0 0
11 %ID0.3.4.0 Channel 4 counter value %ID0.3.4.0 0
12 %Q0.3.5.0 Channel 5 Clear counter value %Q0.3.5.0 0
13 %ID0.3.5.0 Channel 5 counter value %ID0.3.5.0 0
14 %Q0.3.6.0 Channel 6 Clear counter value %Q0.3.6.0 0
15 %ID0.3.6.0 Channel 6 counter value %ID0.3.6.0 0
16 %Q0.3.7.0 Channel 7 Clear counter value %Q0.3.7.0 0
17 %ID0.3.7.0 Channel 7 counter value %ID0.3.7.0 0
Unforce
Function:
Counter
Task:
MAST
PLC bus
0.3 : BMX E...

The parameters for group 1, 2, 3 debug page for counter is listed in the following table:

Object	Type	Label	Description
%IDr.m.x.0	DINT	Channel *x* counter value	Channel *x* counter value x = 4, 5, 6, 7 (group 1) or 8, 9, 10, 11 (group 2) or 12, 13, 14, 15 (group 3)
%Qr.m.x.0	EBOOL	Channel *x* clear counter value	Channel *x* clear counter value
%IWr.m.x.3	INT	–	TS_DIAGNOSTIC_FLAGS x = 4, 8, 12
%IWr.m.x.3.15	BOOL	Dechatter active	<Group Parameter> If any edges discarded by dechatter filter for any channels under this group.

NOTE: x = channel 4, 5, 6, or 7 (group 1); channel 8, 9, 10, or 11 (group 2); channel 12, 13, 14, or 15 (group 3).

6.3 Configuration Parameters for Channels

Overview

This section describes the configuration parameters for the module, each of its groups, and each channel in the groups.

What Is in This Section?

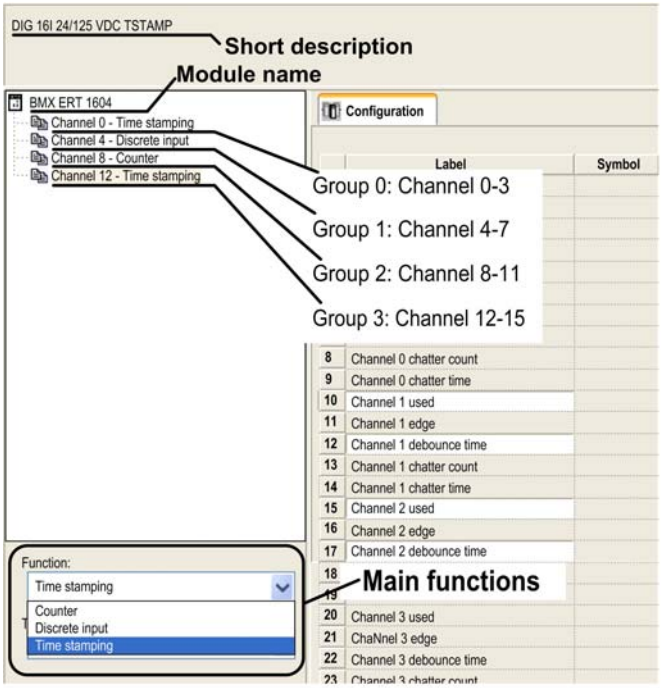
This section contains the following topics:

Topic	Page
Main Function Configuration	97
Configuration for Group 0 Time Stamping	98
Configuration for Group 1, 2, 3 Time Stamping	100
Configuration for Group 1, 2, 3 Discrete Input Without Time Stamping	102
Configuring Group 1, 2, 3 for Counters	104

Main Function Configuration

Configuration

The following figure shows the main function configurations:



For groups 1, 2 and 3, select a function:

- Counter
- Discrete input (without time stamping)
- Time stamping: discrete input with time stamping

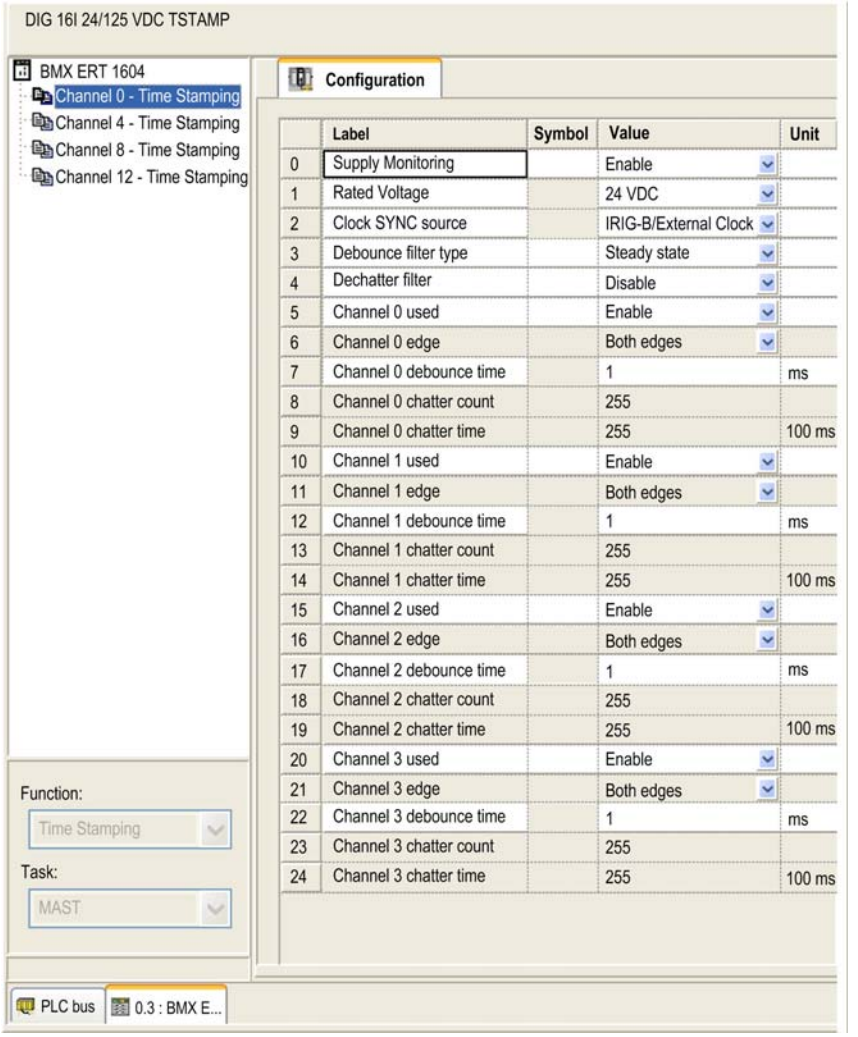
Input group 0 cannot be reconfigured. These inputs always function as discrete input with time stamping.

For all the functions, the BMX ERT 1604 T module only provides MAST **Task** option.

Configuration for Group 0 Time Stamping

Parameters Description

Group 0 parameters:



	Label	Symbol	Value	Unit
0	Supply Monitoring		Enable	
1	Rated Voltage		24 VDC	
2	Clock SYNC source		IRIG-B/External Clock	
3	Debounce filter type		Steady state	
4	Dechatter filter		Disable	
5	Channel 0 used		Enable	
6	Channel 0 edge		Both edges	
7	Channel 0 debounce time		1	ms
8	Channel 0 chatter count		255	
9	Channel 0 chatter time		255	100 ms
10	Channel 1 used		Enable	
11	Channel 1 edge		Both edges	
12	Channel 1 debounce time		1	ms
13	Channel 1 chatter count		255	
14	Channel 1 chatter time		255	100 ms
15	Channel 2 used		Enable	
16	Channel 2 edge		Both edges	
17	Channel 2 debounce time		1	ms
18	Channel 2 chatter count		255	
19	Channel 2 chatter time		255	100 ms
20	Channel 3 used		Enable	
21	Channel 3 edge		Both edges	
22	Channel 3 debounce time		1	ms
23	Channel 3 chatter count		255	
24	Channel 3 chatter time		255	100 ms

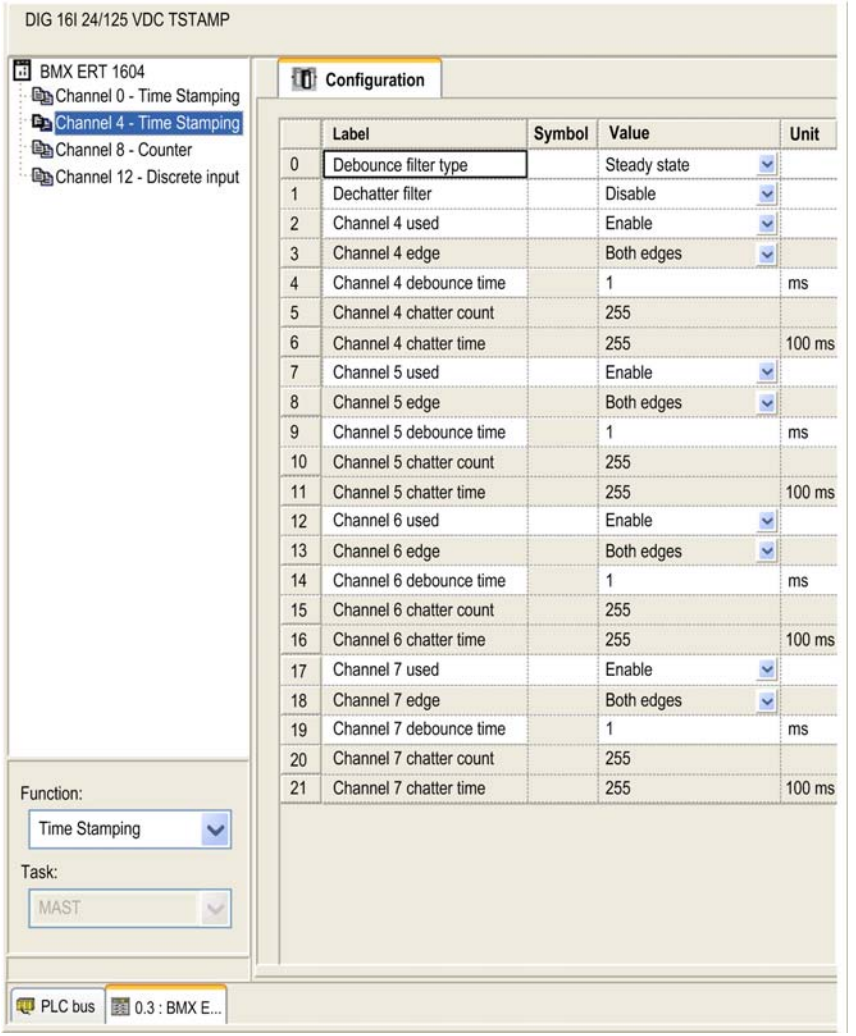
Parameters description:

Label		**Input Type**	**Value**
Function for group 0		Fixed	Value 2: Time stamping
Module Parameters	Supply monitoring	Option	Value 0: Disable, supply monitoring Value 1: Enable, supply monitoring (default)
	Rated voltage	Option	Value 0: 24 Vdc (default) Value 1: 48/60 Vdc Value 2: 110/125 Vdc
	Clock SYNC source	Option	Value 1: Free running/internal clock Value 2: DCFF/external clock Value 3: IRIG-B/external clock (default)
Group Parameters	Debounce filter type	Option	Debounce filter *(see page 19)* Value 0: Steady state, a signal change is only registered if the polarity change remains stable longer than the filter time (each new change resets the filter time) (default) Value 1: Integrating, a signal change is only registered if the time integral of the input signal reaches the programmed filter time taking any polarity change into account
	Dechatter filter	Option	Dechatter filter *(see page 23)* Value 0: Disable, chatter time and chatter count are deactivated (default) Value 1: Enable, chatter filter for event and counter input
Channel *x* Parameters (x = 0...3)	Channel *x* used	Option	Value 0: Enable (default) Value 1: Disable, impedes processing of input data for the input. If disabled, it remains always 0
	Channel *x* edge	Option	Value 0: Both edges (default) Value 1: Rising edge Value 2: Falling edge
	Channel *x* debounce time	Input	Debounce time 0...255 ms (default = 1) 0 = Without internal SW delay Unit: ms
	Channel *x* chatter count	Input	Chatter number 1...255 for event/counter input (default = 1)
	Channel *x* chatter time	Input	Chatter time duration 1...255 x 100 ms (default = 1) Unit: 100 ms

Configuration for Group 1, 2, 3 Time Stamping

Parameters description

Group 1, 2 and 3 time stamping parameters:



	Label	Symbol	Value	Unit
0	Debounce filter type		Steady state	
1	Dechatter filter		Disable	
2	Channel 4 used		Enable	
3	Channel 4 edge		Both edges	
4	Channel 4 debounce time		1	ms
5	Channel 4 chatter count		255	
6	Channel 4 chatter time		255	100 ms
7	Channel 5 used		Enable	
8	Channel 5 edge		Both edges	
9	Channel 5 debounce time		1	ms
10	Channel 5 chatter count		255	
11	Channel 5 chatter time		255	100 ms
12	Channel 6 used		Enable	
13	Channel 6 edge		Both edges	
14	Channel 6 debounce time		1	ms
15	Channel 6 chatter count		255	
16	Channel 6 chatter time		255	100 ms
17	Channel 7 used		Enable	
18	Channel 7 edge		Both edges	
19	Channel 7 debounce time		1	ms
20	Channel 7 chatter count		255	
21	Channel 7 chatter time		255	100 ms

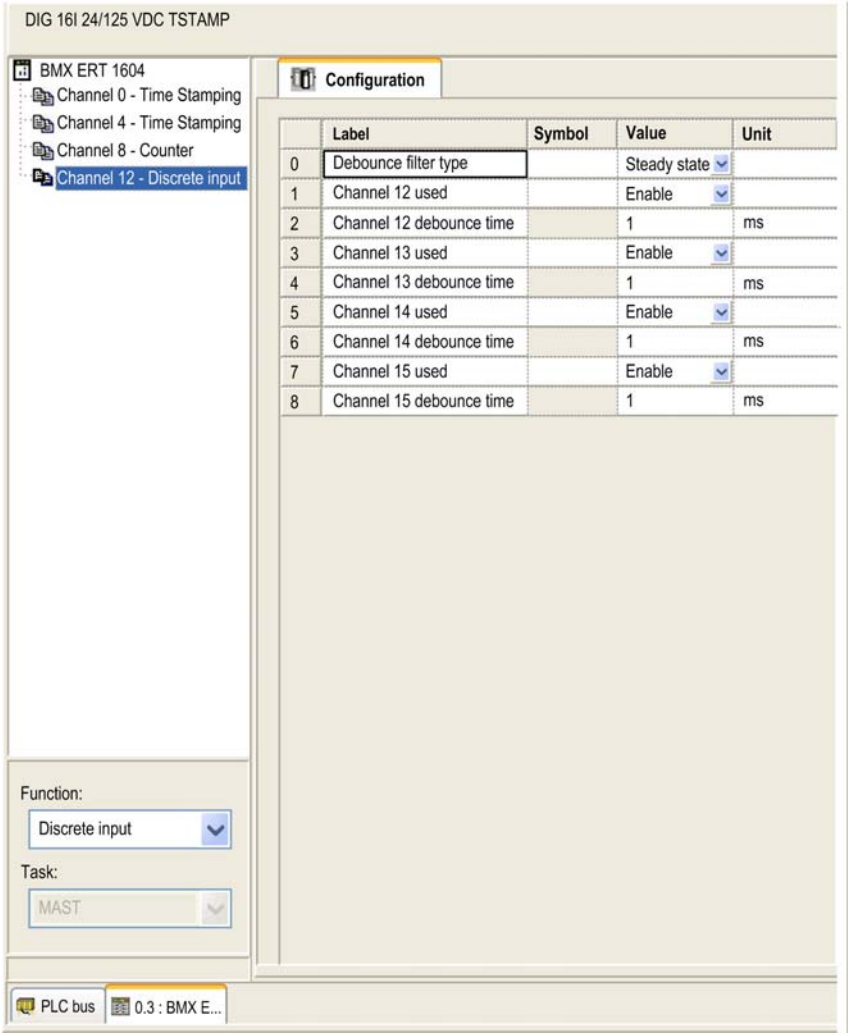
Parameters description:

Label		Input Type	Value
Function for group *x* (x = 4, 8, 12)		Option	Value 0: Discrete input Value 1: Counter Value 2: Time stamping (default)
Group *x* Parameters (x = 4, 8, 12)	Debounce filter type	Option	Debounce filter *(see page 19)* Value 0: Steady state, a signal change is only registered if the polarity change remains stable for longer than the filter time (each new change resets the filter time) (default) Value 1: Integrating, a signal change is only registered if the time integral of the input signal reaches the programmed filter time taking any polarity change into account
	Dechatter filter	Option	Dechatter filter *(see page 23)* Value 0: Disable, chatter time and chatter count are deactivated (default) Value 1: Enable, chatter filter for event and counter input
Channel *x* Parameters (x = 4...15)	Channel *x* used	Option	Value 0: Enable (default) Value 1: Disable, impedes processing of input data for the input. If disabled, remains always 0.
	Channel *x* edge	Option	Value 0: Both edges (default) Value 1: Rising edge Value 2: Falling edge
	Channel *x* debounce time	Input	Debounce time 0...255 ms (default = 1) Value 0: Without internal SW delay Units: ms
	Channel *x* chatter count	Input	Chatter number 1...255 for event/counter input (default = 1)
	Channel *x* chatter time	Input	Chatter filter time duration 1...255 x 100 ms (default = 1) Units: 100 ms

Configuration for Group 1, 2, 3 Discrete Input Without Time Stamping

Parameters Description

Group 1, 2 and 3 discrete input parameters:



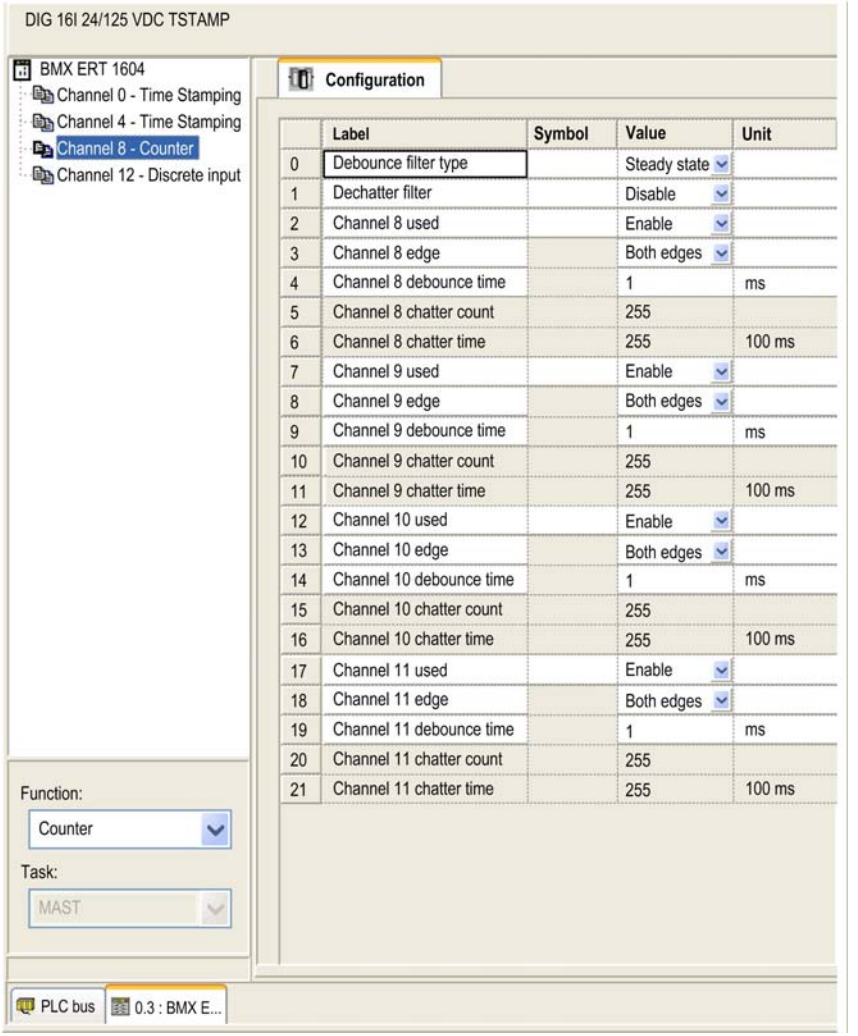
Parameters description:

Label		Input Type	Value
Function for group *x* (x = 4, 8, 12)		Option	Value 0: Discrete input (chosen) Value 1: Counter Value 2: Time stamping
Group *x* Parameters (x = 4, 8, 12)	Debounce filter type	Option	Debounce filter *(see page 19)* Value 0: Steady state, a signal change is only registered if the polarity change remains stable for longer than the filter time (each new change resets the filter time) (default) Value 1: Integrating, a signal change is only registered if the time integral of the input signal reaches the programmed filter time taking any polarity change into account
Channel *x* Parameters (x = 4...15)	Channel *x* used	Option	Value 0: Enable (default) Value 1: Disable, impedes processing of input data for the input. If disabled, remains always 0.
	Channel *x* debounce time	Input	Debounce time 0...255 ms (default = 1) Value 0: Without internal SW delay Units: ms

Configuring Group 1, 2, 3 for Counters

Parameters Description

Group 1, 2 and 3 counters parameters:



	Label	Symbol	Value	Unit
0	Debounce filter type		Steady state	
1	Dechatter filter		Disable	
2	Channel 8 used		Enable	
3	Channel 8 edge		Both edges	
4	Channel 8 debounce time		1	ms
5	Channel 8 chatter count		255	
6	Channel 8 chatter time		255	100 ms
7	Channel 9 used		Enable	
8	Channel 9 edge		Both edges	
9	Channel 9 debounce time		1	ms
10	Channel 9 chatter count		255	
11	Channel 9 chatter time		255	100 ms
12	Channel 10 used		Enable	
13	Channel 10 edge		Both edges	
14	Channel 10 debounce time		1	ms
15	Channel 10 chatter count		255	
16	Channel 10 chatter time		255	100 ms
17	Channel 11 used		Enable	
18	Channel 11 edge		Both edges	
19	Channel 11 debounce time		1	ms
20	Channel 11 chatter count		255	
21	Channel 11 chatter time		255	100 ms

Parameters description:

Label		Input Type	Value
Function for group *x* (x = 4, 8, 12)		Option	Value 0: Discrete input Value 1: Counter (chosen) Value 2: Time stamping
Group *x* Parameters (x = 4, 8, 12)	Debounce filter type	Option	Debounce filter *(see page 19)* Value 0: Steady state, a signal change is only registered if the polarity change remains stable for longer than the filter time (each new change resets the filter time) (default) Value 1: Integrating, a signal change is only registered if the time integral of the input signal reaches the programmed filter time taking any polarity change into account
	Dechatter filter	Option	Dechatter filter *(see page 23)* Value 0: Disable, chatter time and chatter count are deactivated (default) Value 1: Enable, chatter filter for event and counter input
Channel *x* Parameters (x = 4...15)	Channel *x* used	Option	Value 0: Enable (default) Value 1: Disable, impedes processing of input data for the input. If disabled, remains always 0.
	Channel *x* edge	Option	Value 0: Both edges (default) Value 1: Rising edge Value 2: Falling edge
	Channel *x* debounce time	Input	Debounce time 0...255 ms (default =1) Value 0: Without internal SW delay Unit: ms
	Channel *x* chatter count	Input	Chatter number 1...255 for event/counter input (default = 1)
	Channel *x* chatter time	Input	Chatter filter time duration 1...255 x 100 ms (default =1) Unit: 100 ms

6.4 Configuration in Project Settings

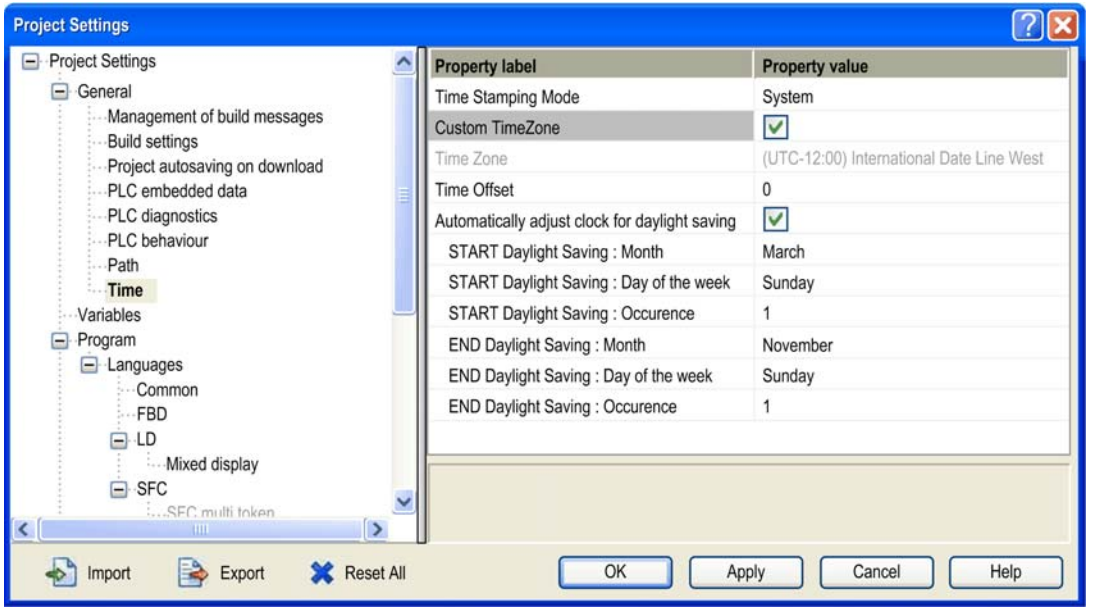
Time and Mode Setting

Time Zone and DST Setting

The external time receivers provide the local time format (year/month/day/minute/second) according to the country. The offsets for daylight saving time (DST) are different for different countries or zones.

The BMX ERT 1604 T module converts the local time to the standard time format which is specified in IEC 61850 (ms from the UTC epoch of 1970-01-01 00:00:00:000). You must set the correct time zone and DST information in the Unity Pro interface.

After the application is created in Unity Pro, click **Tools** →**Project Settings** to display the **Time** tab as shown in the following figure.



You can select the required time zone by using this interface.

If the listed time zone options do not meet your requirements, the **Time Offset** can be used to set the minutes offset from UTC. To enable this function, check the **Custom Timezone** box.

NOTE: The daylight saving time configuration in the **Project Settings** window is not applicable to the BMX ERT 1604 T module. The BMX ERT 1604 T module always gets the daylight saving time to standard time switch information from the external clock (IRIG-B or DCF77) regardless of the DST settings in the **Project Settings** window.

An IRIG-B external clock must support IEEE1344 or IEEE C37.118 standard extension definition for DST information in order to maintain time accuracy during the switch between daylight saving time and standard time.

Solution Mode Setting

The module configuration of solution mode option for BMX ERT 1604 T is done by the **Time Stamping Mode** option in previous interface. The available options are system and applicative.

The solution mode (time stamping mode) option must be selected according to the customer use case:

System: When OPC (OFS by Schneider for example) is used to communicate with the SCADA.

Applicative (default): When Modbus TCP is used to communicate with the SCADA.

Using BMX ERT 1604 T in a Modicon M340 Configuration

7

Overview

This chapter describes the use of BMX ERT 1604 T in a Modicon M340 configuration.

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Introduction of Language Objects	110
Details of the Language Objects of the IODDT of Type T_GEN_MOD	111
Language Objects for Channels	112
IODDTs	115

Introduction of Language Objects

Language Object Types

Each IODDT contains a set of language objects allowing its operation to be controlled and checked.

There are two types of language objects:

- **Implicit Exchange Objects:** These objects are automatically exchanged on each cycle revolution of the task associated with the module. They correspond to inputs/outputs of the module (measurement results, information and commands).
- **Explicit Exchange Objects:** These objects are exchanged on the application's request, using explicit exchange instructions.

Details of the Language Objects of the IODDT of Type T_GEN_MOD

Introduction

All the modules of Modicon M340 PLCs have an associated IODDT of type T_GEN_MOD.

Observations

In general, the meaning of the bits is given for bit status 1. In specific cases an explanation is given for each status of the bit.

Some bits are not used.

List of Objects

The table below presents the objects of the IODDT.

Standard Symbol	Type	Access	Meaning	Address
MOD_ERROR	BOOL	R	Module detected error bit	%Ir.m.MOD.ERR
EXCH_STS	INT	R	Module exchange control word	%MWr.m.MOD.0
STS_IN_PROGR	BOOL	R	Reading of status words of the module in progress	%MWr.m.MOD.0.0
EXCH_RPT	INT	R	Exchange report word	%MWr.m.MOD.1
STS_ERR	BOOL	R	Event when reading module status words	%MWr.m.MOD.1.0
MOD_FLT	INT	R	Internal detected errors word of the module	%MWr.m.MOD.2
MOD_FAIL	BOOL	R	module inoperable	%MWr.m.MOD.2.0
CH_FLT	BOOL	R	Inoperative channel(s)	%MWr.m.MOD.2.1
BLK	BOOL	R	Terminal block incorrectly wired	%MWr.m.MOD.2.2
CONF_FLT	BOOL	R	Hardware or software configuration anomaly	%MWr.m.MOD.2.5
NO_MOD	BOOL	R	Module missing or inoperative	%MWr.m.MOD.2.6
EXT_MOD_FLT	BOOL	R	Internal detected errors word of the module (Fipio extension only)	%MWr.m.MOD.2.7
MOD_FAIL_EXT	BOOL	R	Internal detected error, module unserviceable (Fipio extension only)	%MWr.m.MOD.2.8
CH_FLT_EXT	BOOL	R	Inoperative channel(s) (Fipio extension only)	%MWr.m.MOD.2.9
BLK_EXT	BOOL	R	Terminal block incorrectly wired (Fipio extension only)	%MWr.m.MOD.2.10
CONF_FLT_EXT	BOOL	R	Hardware or software configuration anomaly (Fipio extension only)	%MWr.m.MOD.2.13
NO_MOD_EXT	BOOL	R	Module missing or inoperative (Fipio extension only)	%MWr.m.MOD.2.14

Language Objects for Channels

Overview

This section provides the detailed list of channel objects, implicit, and explicit variables for BMX ERT 1604 T module.

Channel Objects

The following table shows the meaning of the channel objects:

Standard Symbol	Type	Meaning	Language Object
–	–	Language element of channel level used for explicit exchanges READ_STS	%CHr.m.c
CH_ERROR	BOOL	Channel detected error bit when this bit is at 1.	%Ir.m.c.ERR

Exchange Status: EXCH_STS

The following table shows the meaning of channel exchange status bits from the EXCH_STS channel (%MWr.m.c.0):

Standard Symbol	Type	Meaning	Language Object
STS_IN_PROGR	BIT	If 1, exchange in progress for READ_STS	%MWr.m.c.0.0
RECONF_IN_PROGR	BIT	If 1, indicates a reconfiguration on channel c of the module from the console (modification of the configuration parameters + cold start-up of the channel)	%MWr.m.c.0.15

Exchange Report: EXCH_RPT

The following table shows the meaning of the report bits of the EXCH_RPT channel (%MWr.m.c.1):

Standard Symbol	Type	Meaning	Language Object
STS_ERR	BIT	Report value: ● 0: correct exchange ● 1: error while reading channel status	%MWr.m.c.1.0
RECONF_ERR	BIT	Report value: ● 0: correct exchange ● 1: error while reconfiguring the channel	%MWr.m.c.1.15

Channel Error: CH_FLT

The following table shows the meaning of the report bits of the CH_FLT channel (%MWr.m.c.2):

Standard Symbol	Type	Meaning	Address
EXT_PWS_FLT	BIT	External power supply interruption	%MWr.m.c.2.0
INTERNAL_FLT	BIT	Application detected error	%MWr.m.c.2.4
CONF_FLT	BIT	Hardware or software configuration detected error	%MWr.m.c.2.5
COM_FLT	BIT	Communication error with PLC	%MWr.m.c.2.6

Implicit Input %I

The following table shows the meaning of the implicit inputs (%I):

Standard Symbol	Type	Meaning	Address
Channel *x* value	EBOOL	Discrete input channel value parameters are for each channel (c = 0...3, 4...7, 8...11, 12...15 in each FB)	%Ir.m.c.0
Channel *x* counter value	DINT	Counter value (Default: 0 if counter function is not chosen) Parameters are for each channel (c = 0...3, 4...7, 8...11, 12...15 in each FB)	%IDr.m.c.0
TIME_STAMP_RECORDS	INT	The number of Time Stamp records in module buffer	%IWr.m.0.2

Standard Symbol	Type	Meaning	Address
TS_DIAGNOSTIC_FLAGS	INT	Indicators providing diagnostic information about the source time stamped events service	%IWr.m.0.3
TIME_VALID	BIT	Time OK and synchronized	%IWr.m.0.3.0
CLOCK_FAILURE	BIT	Same as ClockFailure Indication in the TimeQuality	%IWr.m.0.3.1
CLOCK_NOT_SYNC	BIT	Same as ClockNotSynchronized Indication in the TimeQuality	%IWr.m.0.3.2
BUFF_FULL	BIT	Buffer full	%IWr.m.0.3.3
SOE_UNCERTAIN	BIT	Variable to assign an SOE uncertain Event ID	%IWr.m.0.3.7
UMAS communication error	BIT	UMAS communication detected error	%IWr.m.0.3.9
–	–	(c = 0, 4, 8, 12 in each FB)	%IWr.m.c.3
Dechatter active	BIT	If any edges discarded by dechatter filter for any channels under this group	%IWr.m.c.3.15
TS_BUF_FILLED_PCTAGE	INT	Percentage of the buffer filled [0...100]	%IWr.m.0.4
TS_EVENTS_STATE	INT	Main state of the TS events service (reserved)	%IWr.m.0.5

Implicit Command Objects %Q

The following table shows the meaning of the implicit command objects (%Q):

Standard Symbol	Type	Access	Meaning	Address
Clear event buffer	EB00L	R/W	Clear event buffer	%Qr.m.0.0
Channel x clear counter value	EB00L	R/W	Clear channel c counter value Parameters are for each channel (c = 4...15 in each FB)	%Qr.m.c.0

IODDTs

Overview

The IODDTs are predefined and contain language objects of inputs/outputs belonging to the channel of the module.

The BMX ERT 1604 T module has the following associated IODDTs:

- T_ERT_CNT: For channels configured as counter
- T_ERT_TS_MOD: For channel 0 with time stamping function (with module status bits included)
- T_ERT_TS: For channels 1...15 which are configured as time stamping
- T_DIS_IN_GEN: For channels configured as discrete input or channels 1...15 configured as time stamping

As any Modicon M340 module, the BMX ERT 1604 T module also has a T_GEN_MOD *(see page 111)* IODDT associated.

T_ERT_CNT, T_ERT_TS_MOD, and T_ERT_TS are specific IODDT for BMX ERT 1604 T module while T_DIS_IN_GEN is a generic IODDT for all discrete input.

T_ERT_CNT

The following table shows the meaning of T_ERT_CNT IODDT:

Standard Symbol	Type	Access	Meaning	Language Object
CH_ERROR	BOOL	R	Channel error	%Ir.m.c.ERR
CURRENT_VAL	UDINT	R	Counter value	%IDr.m.c.0
CLR_COUNTER	EBOOL	R/W	Clear counter	%Qr.m.c.0
DECHATTER_ACT	BOOL	R	Dechatter active (information visible on each CNT channel of a group with the same value)	%IWr.m.c.3.15

T_ERT_TS_MOD

The following table shows the meaning of T_ERT_TS_MOD IODDT:

Standard Symbol	Type	Access	Meaning	Language Object
CH_ERROR	BOOL	R	Channel error	%Ir.m.c.ERR
VALUE	EBOOL	R	Channel input value	%Ir.m.c.0
TIME_STAMP_RECORDS	INT	R	The number of Time Stamp records in module buffer	%IWr.m.c.2

Standard Symbol	Type	Access	Meaning	Language Object
TS_DIAGNOSTIC_FLAGS	INT	R	Diagnostic information about the source time stamped events service	%IWr.m.c.3
TIME_VALID	BOOL	R	Time OK and synchronized	%IWr.m.c.3.0
CLOCK_FAILURE	BOOL	R	Same as ClockFailure indication in the TimeQuality	%IWr.m.c.3.1
CLOCK_NOT_SYNC	BOOL	R	Same as ClockNotSynchronized indication in the TimeQuality	%IWr.m.c.3.2
BUFF_FULL	BOOL	R	Buffer full	%IWr.m.c.3.3
SOE_UNCERTAIN	BOOL	R	Variable to assign an SOE uncertain Event ID	%IWr.m.c.3.7
UMAS_COM_ERR	BOOL	R	UMAS communication error	%IWr.m.c.3.9
DECHATTER_ACT	INT	R	Dechatter active	%IWr.m.c.3.15
TS_BUF_FILLED_PCTAGE	INT	R	Percentage of the buffer filled [0...100]	%IWr.m.c.4
TS_EVENTS_STATE	INT	R	Main state of the TS events service (Debug purpose)	%IWr.m.c.5
CLR_EVENT_BUF	EBOOL	R/W	Clear event buffer	%Qr.m.c.0
EXCH_STS	INT	R	Exchange status	%MWr.m.c.0
EXCH_IN_PROGR	BOOL	R	Status paramter read in progress	%MWr.m.c.0.0
RECONF_IN_PROGR	BOOL	R	Reconfiguration in progress	%MWr.m.c.0.15
EXCH_RPT	INT	R	Channel report	%MWr.m.c.1
STS_ERR	BOOL	R	Detected error while reading channel status	%MWr.m.c.1.0
RECONF_ERR	BOOL	R	Detected error while reconfiguring the channel	%MWr.m.c.1.15
CH_FLT	INT	R	Standard channel errors	%MWr.m.c.2

Standard Symbol	Type	Access	Meaning	Language Object
EXT_PWS_FLT	BOOL	R	External power supply inoperable error	%MWr.m.c.2.0
INTERNAL_FLT	BOOL	R	Inoperable channel or module missing	%MWr.m.c.2.4
CONF_FLT	BOOL	R	Inoperable hardware or software configuration error	%MWr.m.c.2.5
COM_FLT	BOOL	R	Communication error with PLC	%MWr.m.c.2.6

T_ERT_TS

The following table shows the meaning of T_ERT_TS IODDT:

Standard Symbol	Type	Access	Meaning	Language Object
CH_ERROR	BOOL	R	Channel error	%Ir.m.c.ERR
Value	EBOOL	R	Channel input value	%Ir.m.c.0
DECHATTER_ACT	BOOL	R	Dechatter active (information visible on each TS channel of a group with the same value)	%IWr.m.c.3.15

T_DIS_IN_GEN

The following table shows the meaning of T_DIS_IN_GEN IODDT:

Standard Symbol	Type	Access	Meaning	Language Object
CH_ERROR	BOOL	R	Channel error	%Ir.m.c.ERR
VALUE	EBOOL	R	Counter input value	%Ir.m.c.0

Using BMX ERT 1604 T in ERIO Drop

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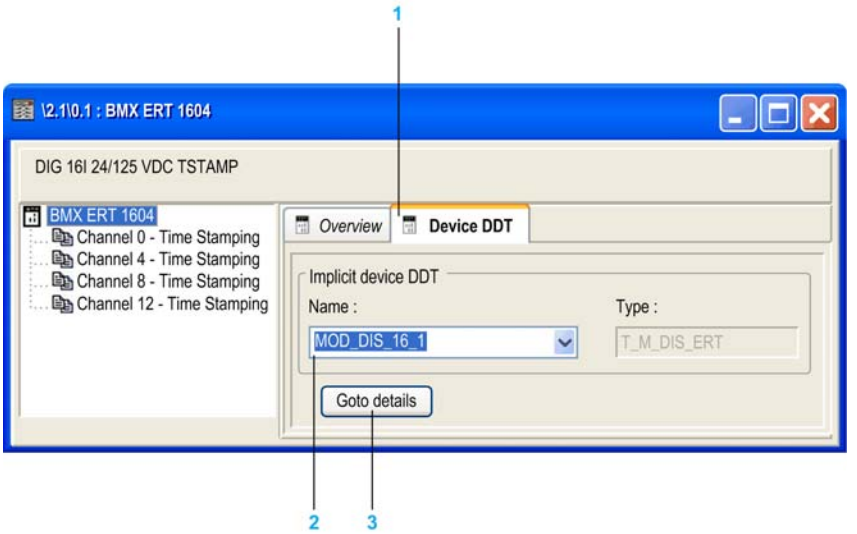
Device DDTs in BMX ERT 1604 T

Overview

In a Quantum EIO application, the online display tabs are suppressed. Also, the I/O objects tab and IODDT are replaced by a device DDT tab.



1 Device DDT Tab
2 Device name automatically attributed
3 Command button to display device DDT details

Implicit Device DDTs

The following table shows the meaning of T_M_DIS_ERT, T_M_DIS_ERT_CH and T_M_TIME_SYNC_ERT implicit device DDTs:

Implicit Device DDT Type	Standard Symbol	Type	Access	Meaning
T_M_DIS_ERT	MOD_HEALTH	BOOL	R	• **0**: the module has a detected error • **1**: the module is operating correctly
	MOD_FLT	BYTE	R	Module internal detected errors byte
	ERT_SYNC	T_M_TIME_SYNC_ERT	–	–
	ERT_CH	ARRAY [0...15] of T_M_DIS_ERT_CH	–	–
T_M_DIS_ERT_CH	FCT_TYPE	WORD	R	• **0**: Discrete Input • **1**: Counter • **2**: Time Stamping
	CH_HEALTH	BOOL	R	–
	DIS_VALUE	EBOOL	R	–
	CNT_VALUE	UDINT	R	–
	CLR_CNT	EBOOL	R/W	Clear counter

Implicit Device DDT Type	Standard Symbol	Type	Access	Meaning
T_M_TIME_SYNC_ERT	TS_TIME_STAMP_RECORDS	UINT	R	Current events number in buffer
	TS_DIAGNOSTIC_FLAGS	WORD	R	Event buffer flags
	TIME_VALID	BOOL	R	Time OK and synchronized
	CLOCK_FAILURE	BOOL	R	Same as ClockFailure indication in the TimeQuality
	CLOCK_NOT_SYNC	BOOL	R	Same as ClockNotSynchronized in the TimeQuality
	BUFF_FULL	BOOL	R	Buffer full
	UMAS_COM_ERR	BOOL	R	UMAS communicator
	DECHATTER_ACT_0	BOOL	R	Dechatter active on channels 0...3
	DECHATTER_ACT_1	BOOL	R	Dechatter active on channels 4...7
	DECHATTER_ACT_2	BOOL	R	Dechatter active on channels 8...11
	DECHATTER_ACT_3	BOOL	R	Dechatter active on channels 12...15
	TS_BUF_FILLED_PCTAGE	BYTE	R	Percentage of the buffer filled (0...100)
	TS_EVENTS_STATE	BYTE	R	Main state of the TS events service (debug purpose)
	SOE_UNCERTAIN	BOOL	R	SOE uncertain variable
	CLR_EVT_BUF	EBOOL	R/W	Clear event buffer **NOTE:** Only available for applicative time stamping mode.

Explicit Device DDT

Optional explicit DDT types are proposed in the data editor to support Status or Command data used by explicit exchanges on a channel of an IO module in a Modicon M340 remote I/O drop. Explicit DDT instances are created manually by the user in the data editor and used as Output parameter with the function block managing the explicit exchange (READ_STS_QX).

The following table shows the meaning of T_M_DIS_ERT_CH_STS explicit device DDT:

Explicit Device DDT type	Standard Symbol	Type	Access	Meaning
T_M_DIS_ERT_CH_STS	CH_FLT	INT	R	Standard channel errors
	EXT_PWS_FLT	BOOL	R	External power supply error
	INTERNAL_FLT	BOOL	R	Inoperable channel or module missing
	CONF_FLT	BOOL	R	Hardware or software configuration detected error
	COM_FLT	BOOL	R	Communication error with PLC

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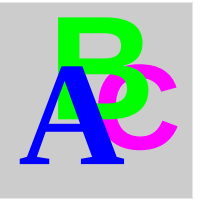

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